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VOLUME 8, No. 12 **DECEMBER 1956**

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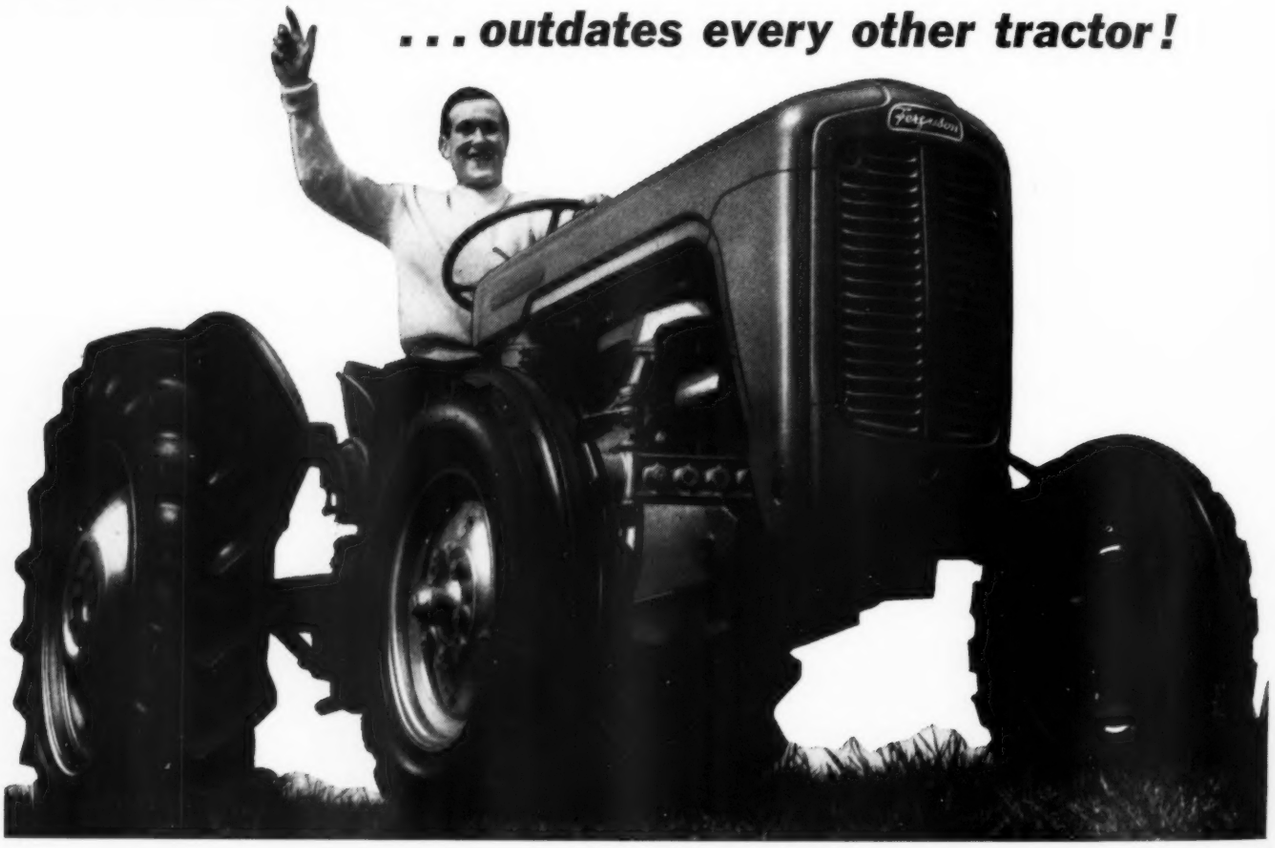

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WORLD CROPS

Vol. 8, No. 12

CONTENTS

DECEMBER 1956

EDITORIAL COMMENT:
Atomic Energy—A Power for Good; Apple and Pear Crop Survey; Eucalypts for Asia; No Plough, No Crop; Tomato Troubles in New Zealand; Isotope Farming; British Fertiliser Consumption 463

The Work of FAO 467

Commonwealth Agricultural Bureaux Organisation—*Sir Herbert Howard* 472

The U.S. Department of Agriculture 475

Role of the National Institute of Agricultural Engineering—*E. Harris* 478

The Snowy Mountains Scheme—*C. M. Gray*, O.B.E., E.D., M.SC., A.M.I.E. (AUST.) 483

Copra Production by the Smallholder: II—*F. C. Cooke* 489

The New Ferguson Tractor 492

New Publications 495

Machinery and Equipment 497

Agricultural Chemicals 501

World Crop Reports 503

Index for 1956

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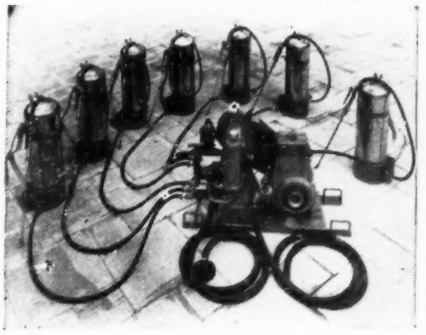

After Coffee...

TEA

Before Ceylon became famous for its tea—it was famous for its coffee. Early in the 1800s the steep green slopes of the island's hill jungle were cleared and cultivated by coffee planters, mostly Scots, and coffee soon became the major crop. Then in 1869 came disaster: a devastating blight attacked the trees and within a few years the whole industry was wiped out. So the resourceful Scots planted tea instead ....

But the tea bushes of Ceylon have constantly to be protected against diseases — among them Blister Blight. Here the problem was not to find a fungicide — a copper compound was known to be effective — but to develop a technique of spraying the bushes so that the fungicide could penetrate and do its job. Plant Protection Ltd was called in and, in collaboration with the Tea Research Institute, they evolved a technique of low-volume spraying which proved completely satisfactory.

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Editorial Comment

Atomic energy—a power for good

At a recent conference of editors of food journals held at UN Headquarters, New York, Dr. R. A. Silow of FAO addressed the assembly on ' The Contributions of Atomic Energy to Agriculture '. Dr. Silow said that as an agriculturist he was frequently asked what connection there possibly can be between atomic energy and agriculture. The connection can perhaps best be placed in its proper perspective if two important features of atomic energy are remembered. Firstly, it should be remembered that atomic energy is not an altogether new intrusion into man's way of life, but has, in fact, been part of his daily experience since the dawn of creation. Nuclear energy has always been with us, and we have been used to looking at an immense nuclear reactor every day of our lives. That nuclear reactor is, of course, the sun—and the source of its warmth and light is much the same fusion process that is utilised in the so-called ' hydrogen bomb '.

The second feature that should be remembered about this atomic energy with which we have so long been familiar—a feature that is perhaps seldom realised—is that, far from having been an adverse influence in our lives, it always has been, is, and always will be, the ultimate source of all our food and all our bodily comforts, including warmth, shelter and, indeed, our very vital energy itself. Our solar nuclear reactor is the one thing that has made possible life as we know it on this planet, for the energy in the sun's rays, derived from a nuclear fusion reaction, is absorbed by green plants on which animals, and ultimately man, are dependent for their food. We may, therefore, say that atomic energy is the very foundation of all our agriculture and that we are dependent upon it for our food supplies, our timber for shelter, our clothing and our conventional fuels—wood, coal and oil—that give us most of our heat and power.

One application of radiation relates to its use in connection with plant breeding. It has long been known that radiation causes heritable mutations in plants and animals, and with the advent of atomic energy further kinds of radiation and more potent sources have become freely available for experimental use. Although the vast majority of mutations induced by radiation are deleterious, desirable types occur in low proportion and have been selected in a wide variety of crops. A strain of oats resistant to one of the most damaging rust diseases in the Middle West of the U.S.A. has been developed by this means. In Sweden stiff-strawed types of barley particularly suitable for mechanical harvesting have been obtained and the most widely grown variety of white mustard in that country, with improved yield and higher oil content, was also developed by irradiation. This method of accelerating plant breeding is already under investigation in many countries of the world. The technique is not so readily applicable to livestock improvement because of the greater difficulty of experimentation involved, but the possibility of developing by this means strains of poultry with a higher egg production is already under investigation in the U.S.A.

Realising, therefore, how much this could mean to agriculture on a world scale, FAO is embarking upon a programme for promoting the applications of atomic energy in agriculture. At this early stage in the development of atomic energy FAO's most important function is to stimulate necessary investigations and encourage the exchange of information arising from research so that all countries may benefit from the substantial and rapid advances that are being made. To this end FAO is organising, in the Netherlands in December of this year, the first meeting of a newly constituted European Contact Group on the Uses of Radiation and Isotopes in Agricultural Research, and in succeeding years this type of activity will be extended to other regions of the world. In this and other ways FAO intends to do all that it can to ensure that the immense potential contributions of atomic energy to agriculture are translated into realities for the benefit of all peoples.

Apple and pear crop survey

THE OEEC Working Party on Fruit and Vegetables, which met at the beginning of October, reached some interesting conclusions regarding the production and intra-European trade in apples and pears during the 1956–57 season.

The 1956 crop for dessert and cooking apples for the whole of the OEEC area will be considerably higher than the exceptionally low level of crops during the previous year. Volume of production for the OEEC area as a whole is nearly 30% higher than the 1955–56 crop, says the Working Party. However, it is still lower than the 1954–55 crop, which, it will be remembered, was the highest ever recorded.

The increase in production for the area as a whole is due to much higher crops in the importing countries, chiefly in Germany, where production has nearly doubled, in Sweden and in the U.K., whereas in the exporting countries as a whole production remains stable or even slightly smaller than in the previous year. The Italian and Belgian crops, for example, are lower and Swiss and Dutch crops are very good.

As a result of this situation, intra- and non-European trade will be considerably modified by comparison with last year. Some importing countries—for instance, Germany—foresee a large reduction of their imports, the volume of which would probably be 50% lower than in 1955–56. Italy, taking into account the various factors, foresees an appreciable reduction of her exports. It thus appears that, although increases in exports are foreseen in the Netherlands and in Switzerland, exports from the OEEC area as a whole will probably be reduced by one-fifth.

Referring to crop forecasts for dessert and cooking pears in the present season, the Working Party forecasts that in member countries as a whole there will be a decline of some 10% in production as compared with the previous crop year. The total volume of crops has thus continued the decline which has become apparent during the years following the record crop of 1952–53.

The fall in production for the OEEC area seems to be somewhat more marked in exporting countries than for importing countries. In fact, the crops of the chief exporting countries—Italy, the Netherlands and Belgium—are falling, whereas in the case of importing countries the reduction does not apply to all countries, the chief exceptions being the U.K. and Sweden. Production in Sweden has trebled compared with 1955–56.

In view of the low level of crops in the chief exporting countries, especially Germany, these countries are expecting a slightly increased volume of imports as compared with the previous season. The reduced level of crops in exporting countries indicates a slight reduction in the quantities they will have available for export.

Eucalypts for Asia

FORESTRY leaders are looking increasingly to the possibilities of quick-yielding eucalyptus species to fill Asia's needs for fuel and timber. At present, according to Sukhum Thirawat, Forest Conservator in Thailand's Royal Forest Department, Asia imports 2 million cu. m. of timber annually. Its *per caput* forest area on a regional basis is almost the lowest in the world; an estimated 8 million ha. of new forest is needed yearly in order to keep up with the region's population increase.

With careful analysis of performance and judicious selection of species, eucalypts could profitably be sown in three of the four climatic zones of Asia. Such planting programmes would, of course, be in addition to measures to increase the production of suitable existing forested areas. In preparing tests of the approximately 600 types of eucalyptus available from their Australian home Asian foresters should draw on the experience in other countries made available through FAO.

Eucalyptus plantations would be both suitable and desirable as a source of industrial raw materials, such as pulp and fabricated wood products. The fast rate of growth and durability of the timber make the trees valuable as a source of posts and poles for hydro-electric transmission systems. They would contribute to badly needed soil-conservation programmes and, increasingly, would help meet the growing demand for wood fuel.

Mr. Thirawat said that Asian experience with actual eucalyptus plantations has not been extensive except in India, where a 1,800-acre tract has been a qualified success. But, he added, regardless of past records, we owe it to ourselves as practical foresters to give the ubiquitous and versatile eucalypts a correct evaluation and adequate trial.

'No plough, no crop'

EFFICIENT ploughing is the first requirement in the process of crop cultivation, and in order to encourage the craft and skill of ploughing the World and British Ploughing Championships were held at Shillingford, Oxfordshire, on 10, 11 and 12 October. ' No plough, no crop ' was the basic idea underlying the championships.

Mr. D. Heathcoat Amory, Minister of Agriculture, welcoming the World Ploughing Contest to Britain, said: ' Ploughing is still the first operation in the preparation of a seed bed over most of the world. The skill with which the operation is done can have a profound effect on the yield of the crop and in weed control. The World Ploughing Contest spotlights this human element and helps to keep the highest standards before the eyes of the farmers of the world '.

Throughout the three-day ploughing event part of the 400-acre site was occupied by demonstrations and exhibits of a wide range of farm machinery. Implements of many types from different countries were to be seen in action in the field. Nearly 130 leading manufacturers took concessions in the demonstration or exhibition areas. The display ranged from tillage implements, drainage and irrigation equipment to seeds and fertilisers. The whole event was claimed to comprise the most extensive and varied demonstration of farm machinery to be staged in Britain.

This was the fourth World Ploughing Contest and the first to be held in Britain. Previous contests were in Canada in 1953, Eire in 1954 and Sweden in 1955. Next year it will be held in Ohio, U.S.A.; in 1958 at Stuttgart, Germany; and in 1959 near Coleraine, Northern Ireland. A Northern Ireland competitor won this year's event; it was, in fact, the third time that he has carried off this high honour. There can be little doubt that these contests are doing much to stimulate an interest in the craft of ploughing. It is to be hoped that this interest will spread in such a way that the essential work of ploughing on farms throughout the world will be improved.

Tomato troubles in N.Z.

SCIENTIFIC advances in cropping have often told the old story of one pace forwards and another pace back. Early triumphs of DDT in orchards were followed by serious increases in red spider mite attacks because DDT had also killed off the mites' natural enemies—and another spray had to come into the programme to deal with the red spider mites. The use of fruit-setting sprays in New Zealand tomato-houses has been followed by epidemic-scale attacks of *Botrytis* fruit-rot, especially on lower trusses. At first thought this seems a strange case of *sequitor*, but the explanation is simple enough. With normally pollinated flowers the dead petals at the style ends of developing fruits are rapidly shed; but when a fruit-setting substance like β-naphthoxyacetic acid has been used the petals tend to be retained under the calyx or on the side of the fruit. It is these dead petals that act as sites of initial invasion. Even without the use of fruit-setting sprays, dead petals that fall upon lower trusses can foster *Botrytis* infections of the growing fruit, but when the host material remains in contact with fruit the risk of serious incidence is far greater.

In the past six years *Botrytis* outbreaks in the Auckland province have been large, although formerly they were slight. Hand removal of the dead petals has not only proved a tedious remedy, but the petals are often so tightly attached to the fruit that damage results. Research has therefore had to find a fungicide that can be combined with the usual fruit-setting spray substances, and a series of three papers in the *N.Z. Journal of Science and Technology* (1956, [A] **38,** 2, 166) shows that this task has been accomplished, though not without development problems.

The modern organic fungicides of the thiocarbamate class have proved outstandingly suitable, both for *Botrytis* control and compatibility with fruit-setting substances. In final commercial trials the best results were given by ferbam and thiram, though in earlier phases of the investigation ziram and dichlone also seemed promising. Maximum control, however, is not achieved by one combination spray of fruit-setting substance and fungicide—a second spray of fungicide alone some seven to 12 days after setting is also needed, an unfortunate but necessary addition to the spraying programme. It hardly seems that this extra ' chore ' seriously reduces the benefits of chemical fruit-setting, though it does repeat the old theme of ' one more spray after another '.

Isotope farming

ISOTOPE farming is the culture of biochemicals by raising plants and animals in an isotopically enriched environment, such as an atmosphere of radioactive carbon dioxide. The difficulties of direct synthesis of most biochemicals are such that isotope farming is an attractive method for their production. In this manner, it is possible to raise any plant, and in principle any animal, so that there is equal probability that the carbon atoms in the molecule will be either stable or radioactive and, therefore, a condition of uniform labelling of the entire plant or animal will result. The first experiments were done, said Dr. Willard F. Libby of the U.S. Atomic Energy Commission at the opening of a new radioisotope farm at the Medical College of Virginia, with small gas-tight laboratory assemblies so that the simplest molecules could be produced in labelled form. However, the labelling generally was non-uniform for the reason that the plant had not been in a radioactive environment during its entire life history.

The first large isotope farm was that installed at the Argonne National Laboratory several years ago. It used the laboratory culture methods developed by Dr. Geiling and others and applied them on a larger scale. These were refined further and applied for several years by Dr. Norbert J. Scully, in whose skilful hands the potentialities of a full-scale farm were demonstrated. Dr. Scully's main efforts were devoted to plant culture, and the problems of closing the cycle by feeding animals with radioactive plants and utilising the animal fertiliser and excretion products for fertilisation of ' second generation ' plants has not as yet been solved. It may well be that the difficulties of closing the cycle are so large that, as compared to the benefits, it may be unwise to insist on this last feature of perfection, but in the end one might hope that an isotope farm would be a closed system in which the plants and animals were in equilibrium and the marking isotopes were circulating freely.

In especially designed chambers, plants such as alfalfa, soya bean, buckwheat, rye, tobacco, foxglove, poppy etc. have been cultured in a radioactive-carbon dioxide atmosphere, so that all their substance has been labelled with radiocarbon atoms in proportions of a few atoms of carbon-14 for every million ordinary carbon atoms. These plants have served to produce a number of useful radiochemicals.

In the first place, it has been possible to detect and isolate natural products from these plants, which occur in concentrations which are beyond the limit of detection with the use of ordinary chemical assay methods. Among the more important of the labelled compounds isolated have been digitoxin, morphine, nicotine, sugars, amino-acids, proteins and vitamins. With many of these compounds this is the only way in which they can be obtained at the present time in radioactive form for use in tracer research or diagnostic applications.

By way of example, the digitoxin so produced has been used to study the problem of placental transfer. Radioactive digitoxin was given to four pregnant women and the concentration of the labelled drugs and its metabolic products determined in the various foetal

organs. Less than 1% of the administered glycoside was detected in the foetus as unchanged digitoxin and less than 3.5% as its metabolites.

As an additional example, the effect of morphine antagonists on the distribution and excretion of morphine has been studied in mice, using the radioactive labelled morphine. Marked and significant changes in the carbon-14 distribution in the tissues and organs were observed.

There are, in general, two means by which antagonism could modify the action of morphine: (*a*) facilitation of more rapid conjugation, or (*b*) promotion of more rapid excretion of the unchanged drug.

These applications listed are purely illustrative. It is clear that in the products from the isotope farm one has an essentially limitless reservoir of tools for the investigation of biochemical mechanisms. Certainly the future benefits of labelled medicinals from farms will be many times those already obtained.

It has been well demonstrated already that the isotope farm products are of great value in biochemical and medical research. There is another possibility, namely, that doctors may come to the farm for radioactive-labelled medicines in normal medical practice for diagnostic purposes.

With the exception of oxygen and nitrogen, radioisotopes of most of the physiologically important elements can be introduced into living organisms by the farming technique. These include, most importantly, in addition to radioactive carbon, radioactive hydrogen or tritium; the 12.25-year half-life isotope of hydrogen; radioactive sulphur, the three-month half-life isotope of sulphur; radioactive chlorine, the 2-million-year isotope of chlorine; the three-year radioactive sodium-22; and possibly 14-day radioactive phosphorus, even though its half-life is relatively short. With these five or six isotopes plants and animals can be labelled for half of their elements and so serve as sources for all of the biochemicals.

Consider the labelling with tritium of such a simple biological fluid as water; saline solution made in this way can be used for blood volume determinations—the technique consisting of withdrawal of the sample of blood and the addition of a known volume of the radioactive saline solution and the re-injection followed by subsequent sampling of the blood to determine the extent to which the radioactive tritium had been diluted. This measurement might well prove to be very useful in diagnosis of certain abnormalities. Certainly there seems to be no doubt that one of the great benefits of the atom will be not only the use of isotopes in medical research, but their use in routine diagnostic practice.

One must be careful to keep the amounts of radioisotopes ingested by the patients below any dangerous levels. Fortunately, this is easily possible when modern radiation detection techniques are used. It also seems clear that the costs involved are not excessive and that all that remains to be done is the development of the tests and the marketing of the instruments.

British fertiliser consumption

ALTHOUGH the figures available are still preliminary at the time of comment, it is pleasantly clear that fertiliser consumption in the U.K. took a notable stride forwards in 1955–56. Indeed, the advance apparently made over 1954–55 is comparable with the annual expansions of the wartime and earlier postwar period, when fertiliser prices were pegged to low 1939 levels by a bigger subsidy scheme. A 30% rise in basic slag deliveries is probably largely due to increased supplies of imported slag. The use of straight nitrogenous fertilisers rose by at least 16%; this may reflect a more enterprising policy in grassland treatment and also the greater use of new shorter-strawed cereal varieties. Straight potash use increased by about 13%—and here, of course, without subsidy payments to stimulate consumption. Ordinary superphosphate sales hardly changed, but this is expected in a year when slag use has risen so much and when triple superphosphate is still gaining popularity; a fall in ordinary superphosphate use might rather have been expected.

However, the majority of applications in British farming are given in compound form, and it is always the level of compound use that dominates the picture. The 1954–55 tonnage of 1,863,100 tons rose to 2,035,400 tons for 1955–56 and this latter figure does not include the last month of the year, June. For compounds the rise for the year is at least 8.5%, a most impressive gain—and one even more impressive when it is remembered that most producers introduced more higher-analysis compounds into their 1955–56 lists. On a nutrient content basis rather than the crude basis of tonnage, the effective increase must be above 10%.

It is a fair summing-up to say that 1955–56 was the best 'fertiliser year' since the withdrawal of the lavish wartime subsidy system. Yet this welcome recapture of the expansive tempo of the 1940s is not due to any marked improvement in agriculture's economic prospects or confidence—rather, it has come when prospects have seemed less certain. Perhaps the weather-favoured record harvest of 1955 helped; inasmuch as this was an influence, the effects of the weather-beset 1956 harvest may discourage fertiliser expansion in the current farming year—though, in fact, a wet year brings greater need for nutrient supply in the year that follows. We must hope that the dominant factor has been a wider realisation by farmers that generous fertiliser use is the surest means of reducing production costs per acre and the soundest defence against heavy expenditure upon feeding-stuffs.

THE WORK OF FAO

(Prepared by members of the Staff of FAO, Rome)

' There have been functional international agencies with more circumscribed objectives and tasks, but FAO is the first which sets out with so bold an aim as that of helping nations to achieve freedom from want. Never before have the nations got together for such a purpose '.

FAO was founded by a conference held at Quebec in October 1945, the first of the United Nations specialised agencies to come into existence after the war. An Interim Commission, set up by the Conference on Food and Agriculture called by President Roosevelt at Hot Springs, Virginia, in 1943, had been working for two years on the new Agency's constitution and it was the signing of that document that brought FAO into being with 42 member nations. The new Agency, however, was not just the result of these two conferences, but rather of a long chain of events, one of which was the foundation in Rome, in 1905, of the International Institute of Agriculture. This body was absorbed into FAO, and its founder, David Lubin, is commemorated in the David Lubin Memorial Library, which is housed in FAO's headquarters. Although the I.I.A. had been largely concerned with the collection of agricultural statistics, other groundwork for FAO's foundation had been done by various committees of the League of Nations, which in the late 1930s especially had been concerned at the disparity in nutritional levels among nations, and as between different groups of people within the same nation. Many of the individuals who helped produce the League's reports in this field were among the ' founding fathers ' of FAO, among them Sir John (now Lord) Boyd Orr, the new Agency's first Director-General.

The Agency set up in 1945 was of its very nature experimental, in that no one had ever created quite such a body before, and it has undergone one or two major internal changes since its inception. At present FAO, with a staff of rather more than 1,000, has at its head a Director-General, Mr. B. R. Sen (India), who was elected in September 1956; central Administrative, Programming and Budgeting, and Information Divisions; and five technical divisions, dealing with agriculture, economics, fisheries, forestry and nutrition. The full Conference of 74 member nations meets normally every other year, a Council of 24 members acting as governing body with usually three meetings in the interval between Conference sessions.

Finances

FAO's funds come from two sources. A budget is voted by the Conference, normally for the two years following each session, and based on the programme of work presented by the Director-General for those two years. This regular budget has increased from 4.2 million dollars for the Organisation's first full working year (1946–47) to 6.8 million for 1957, not, in view of the lower purchasing power of money and the enormously enlarged scope of FAO's work, a very great increase.

The second source of funds is the UN Special Fund for Technical Assistance, of which FAO receives a larger share than any other agency, about 28%; in fact, amounting for 1956 to approximately another 8 million dollars. These funds are earmarked exclusively for use in implementing the UN Expanded Technical Assistance Programme (ETAP). Until the creation of this programme, in 1951, FAO had to finance such field operations as it could from its normal budget and field operations were consequently restricted in width as well as in depth. At first the operations carried out under ETAP, tied as they are to definite, specific requests from the governments of the so-called ' under-developed ' countries, constituted a rather separate series of operations from those carried out under the regular programme, but recently there has been more and more integration between the two.

Shri B. R. Sen, elected Director-General of FAO at the Third Special Session of the FAO Conference, 20 September, 1956

Field operations

In the early years field operations fell more or less into two groups: first, missions to member governments, often to advise on an overall plan for agricultural development, but sometimes to investigate on behalf of the government the situation in a single branch of agriculture; and, secondly, broad, often regional projects which dealt with some such subject as the control of animal disease, a plant-breeding programme, or an attack on nutritional problems on a wide front. Although there have been few country missions in recent years, with the exception of a general advisory one sent last year to Yemen, the broad regional programmes have continued to develop, with or without help from ETAP. Outstanding examples of this have been the hybrid-maize programme in Europe and the wide project on rinderpest control, chiefly in the Far East.

The first of these was taken over from UNNRA when that organisation

ceased to function and has been steadily developed for a number of years. The project started with the importation of American maize hybrids into Europe and their testing under European conditions in a number of countries. Later the project moved into a second stage, where hybrids evolved within Europe were tested and disseminated among the interested countries. As a project such as this progresses, FAO is able gradually to withdraw and devote funds to those next at the top of a seemingly endless list. Not all these operations show concrete results, but in so far as hybrid maize is concerned, there is no doubt of the benefits of the programme: the value of the increased production due to planting hybrids in selected European countries in 1954 was estimated at $55 million, although only 6% of the maize acreage was planted with such hybrids.

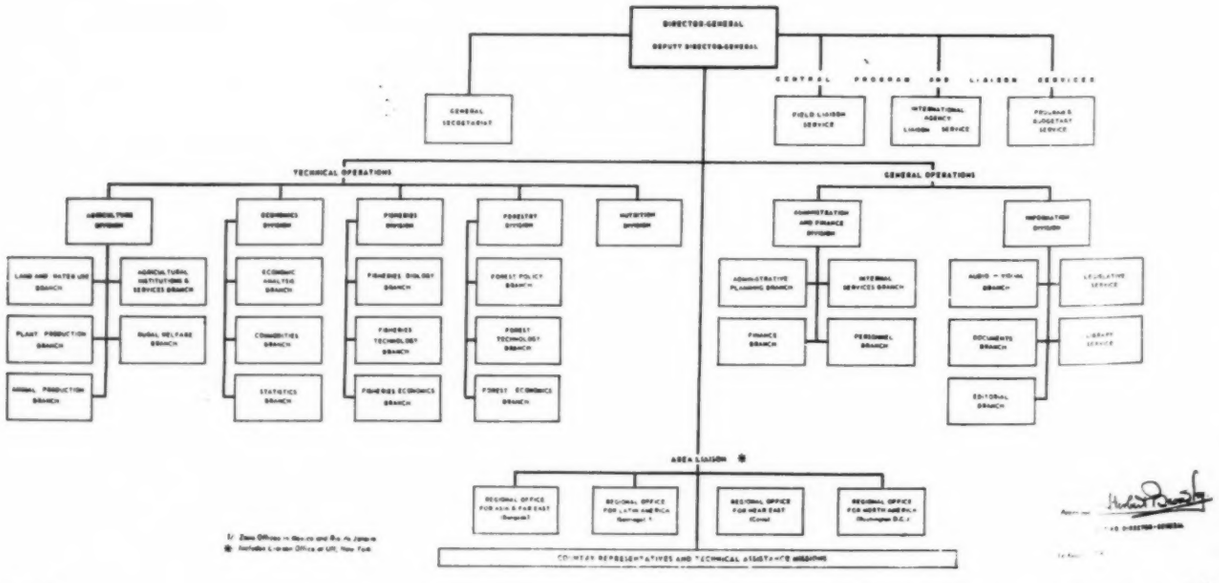
The rinderpest-control programme is a good example of how FAO's activities have been developed and integrated since ETAP funds became available. Started with the assignment of one or two veterinarians to Far Eastern countries and to Ethiopia before ETAP existed, the work was at that time restricted by shortage of funds. As soon as ETAP came into existence, however, countries requested help under this new scheme, and the project began to expand very rapidly and to show considerable success. Afghanistan and Thailand have for some years now been free from outbreaks; in Ethiopia a long-term, country-wide vaccination scheme has been in progress since 1948; and in India, where assistance has been largely in teaching and supervising the production of vaccines by modern methods, steady advances are being made. Moreover, for Thailand, Laos, Cambodia and Viet-Nam a co-ordinated campaign is being planned in co-operation with the U.S. bilateral programme and the International Office of Epizootics.

Both the operations so far referred to come under the work of Agriculture Division, whose programme covers a very wide field indeed. In plant production, for example, there are plant-improvement programmes for many other crops besides hybrid maize already mentioned; work on the control of pests and diseases, such as olive fly in the Mediterranean region, and the large international campaigns against the desert locust which are co-ordinated by FAO in the Near East and some African territories; and a number of projects in agronomy. One of the most important of these is the beginning of a survey which should result in a series of maps of the world's grasslands. First steps in this have already been taken with a survey, at present about half finished, of the grasslands of India, undertaken by Indian Government agronomists after initial work by an FAO expert; at the same time, work is in hand on a grassland map of Africa, and the subject is also being approached regionally in Latin America and South-East Asia.

Animal production

Under the general heading of animal production FAO also covers a very wide field. Of outstanding interest to British farmers, for example, is the European Foot and Mouth Disease Commission, set up in 1954 to help co-ordinate work and pool ideas and information in dealing with this scourge. Co-ordinating bodies for the control of this and other diseases have also been suggested for the Near East and Latin America, in both of which regions FAO has sponsored important meetings on this and other branches of animal production. Other activities of wide interest concern range management, which entails co-operation not only with the plant production branch on the agronomy side, but also with the land and water use branch and certain sections of the Forestry Division. Finally, there is a large and important group of activities concerned with milk production, in which FAO co-operates with other UN agencies, such as UNICEF and WHO. In fact, a call for increased attention to this work was made at the 1955 FAO Con-

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
ORGANIZATION CHART



† Zone Offices in Mexico and Rio de Janeiro
* Includes Liaison Office at UN, New York

ference session, at which the urgency of problems connected with better nutrition of children and other groups was stressed. In this field there is especially close co-ordination between the regular and technical assistance programmes, since a number of experts have been asked for by various countries to help in planning various phases of dairy industry, often where no such industry has hitherto been organised at all. At the same time, the plant production branch advise on the possibility of supporting the increased dairy herds that will need to be created to provide more milk, and Economics Division provide information on the marketing aspects of the problem.

Santo Salvoni was one of the northern Italian farmers who planted test fields of maize hybrids based on the maize hybrids introduced to Europe in the past few years largely on the initiative of FAO

Land and water use

The third main branch of Agriculture Division is that concerned with land and water use, with which is included agricultural mechanisation. This again calls for much advisory work to member governments, who may at times be inclined to go ahead too fast with the purchase of tractor fleets and other equipment. Training, therefore, has played a large part in the work of this section, not only the training of drivers and mechanics, but also that of workshop personnel, and the design and equipping and managing of workshops themselves. Here again general policy worked out by the permanent staff is often implemented in the field by experts working under ETAP. The major work of the land and water use branch, however, is concerned with large development schemes and under ETAP there are sizeable teams of experts appointed through FAO at work in a number of countries. Some of the schemes on which they are working are fairly well advanced, such as that in the Ganges Basin, where a big pilot unit of 220,000 acres is already being operated; others—as, for example, that in which FAO assists the Government of Tanganyika in the development of the Rufji Basin—are still in the early stages, where hydrological and other surveys must be completed before much work can start on the ground. Nonetheless, small pilot farms have been established, from which much can be learned even while the initial survey and planning work is in hand.

Also under this branch comes one of the most important of a series of new activities put forward by Dr. P. V. Cardon, who was Director-General, 1953–56, namely, the world survey of natural resources in FAO's fields. Obviously a project such as this is a very long-term affair, and equally obviously it could not be undertaken by FAO on its own. What is aimed at is a general plan, based on pilot surveys of two or three widely differing areas, from which it is hoped to learn something of the problems which will certainly crop up in such a survey. Work on the first pilot survey area, parts of the Ganges–Bramaputra Basin, will begin this year, and in two other areas it should start next year. Once methodology has been worked out, the aim is that governments should be encouraged to do the survey within their own boundaries, FAO correlating the results, giving advice and possibly providing expert assistance on the ground. Not all of this will be new work, since FAO's Forestry Division has already carried out a world forest inventory, and a separate survey of the world's aquatic resources is also being put in hand through Fisheries Division.

The study of land tenure systems, agrarian reform and allied subjects also comes under the land and water use branch. The results of this work reach FAO's member countries largely through publications, including an important series on *Communal Land Tenure*, *Cadastral Surveys and Records of Rights in Land*, *Inter-relationship between Agrarian Reform and Agricultural Development* (all 1953), *Plantations and other Centrally Operated Estates* (1955) and *Public Lands* (1956). Other publications in this field have included *The Consolidation of Fragmented Agricultural Holdings* (1950) and *Land Settlement for Agriculture* (1951). Besides a number of ETAP projects in this field, mostly in Latin America, FAO is engaged in a joint project with the Italian Government on the appraisal and evaluation of agrarian reform measures in Italy.

Institutions and services

Two other, smaller branches of Agriculture Division deal respectively with agricultural institutions and services, which includes extension and advisory work as such, and the setting up and organisation of research establishments, and with rural welfare. Whereas the former, from the nature of its work, operates largely through the regular programme, the latter branch is responsible for a number of very important ETAP activities. These include several projects, chiefly in

India and the Near East, on the improvement of hides and skins, on the handling and packaging of products such as dates, and on other small rural industries which are in many countries best carried on at the village level. The work of both these branches also ties in rather closely with that of other agencies. For example, in the field extension specialists may best be located at the fundamental education centres which are run by UNESCO, whereas workers in rural industries co-operate with expert advisers from ILO and from the central UN Technical Assistance Administration.

Economics

Reference has already been made to projects which are matters for inter-divisional co-operation within FAO, and, in fact, the co-operation between Agriculture and Economics covers a wide field. Economics Division itself is, in fact, as large, in so far as headquarters staff are concerned, as Agriculture, although it has fewer assignments. Such assignments as there are under this Division are concerned often with the provision of personnel helping governments to develop statistical services, which in many of the less-developed countries are virtually non-existent, and, increasingly in recent years, with advice on marketing and distribution problems. Often FAO has found that the best first step in helping to get statistical services organised or put on a modern basis is by a training centre, usually at the international level. In 1952–53, for example, a demonstration centre on agricultural statistical sampling was held in the Far East; a seminar on price and production statistics, attended by representatives of eight Near Eastern countries, was organised in co-operation with the UN Statistical Office, who also co-operated in a training and demonstration centre on the application of agricultural statistical techniques in Latin America; and more advanced seminars on other aspects of statistical work were held in Stockholm and Ottawa.

Commodity studies

Studies of the commodity situation, at present with a special emphasis on problems relating to products of which there are surpluses in some countries, are a very important aspect of FAO's work in economics. These are centred in the Committee on Commodity Problems, which meets two or three times a year, and which has at present a standing Sub-Committee on Surplus Disposal, situated in Washington. Working groups of one sort or another deal with specific commodities and information in this field is supplied to all member countries through several long and important series of documents, which review from time to time the supply and demand situation in, among other things, wheat, rice, coffee and cocoa. In addition, this division is responsible for the monthly bulletin of agricultural economics and statistics, and the yearbooks on production and trade, recognised as standard works of reference in this field. Separate year books are published by the Fisheries and Forestry Divisions, covering products within their spheres of interest.

Important as are the operations of FAO's Fisheries and Forestry Divisions, there is not the space here to give as detailed an account as that given for Agriculture and Economics. Much forestry work in particular requires close co-operation with that of certain branches of agriculture, and reference has already been made to this in connection with range management and land use planning. Forestry also ties in very closely with certain aspects of economics, especially in Europe, where FAO forest economists, outposted in Geneva, work closely with the Economic Commission for Europe. A notable outcome of this work was the study on timber trends, produced in 1953, which has had considerable effect on long-term forest planning in a number of countries. Long-term policy, in fact, has been a major preoccupation with this division, not only in the abstract, but also through the work of many experts under ETAP, who have been requested by governments to advise them in the formulation of forest policies, hitherto non-existent in many of the less developed countries. Quite apart from this, though affecting policy to some extent, has been FAO's series of studies of the pulp and paper situation, again backed by the work of field experts exploring production of these commodities in regions which have hitherto been entirely dependent on imports. This work itself owes its inspiration partly to resolutions passed by UNESCO and ECOSOC, calling for increased paper supplies to aid the former agency's plans to combat illiteracy throughout the world.

Fisheries

Mechanisation of production is another subject in which FAO has been called upon to advise countries, not only in exploiting their forests, but also in making better use of their fisheries resources. In fact, some of the most successful work of the Fisheries Division has been in this field, especially in helping countries such as Ceylon and India exploit their hitherto unharvested off-shore waters. When it is realised that the world's fisheries resources are at present considered to be only some 50% exploited, and that in many countries fish provide the only convenient source of essential animal protein, the importance of this work can be seen in proper perspective. Similarly, ETAP projects helping the production of freshwater fish have been operated in many countries and request for this type of assistance continues to be made each year.

In connection with fish production, the interdependence of FAO's technical divisions is once more apparent, since Fisheries and Nutrition work closely together in, for example, encouraging the production of fish flour in countries where there is a grave shortage of protein. The problem of protein deficiency is a major one in a great many of FAO's member countries, and the 1955 FAO Conference called for special measures to help deal with it. This reinforced work is already in hand on the part of Nutrition Division, whose experts have for some years tackled the problem in co-operation with WHO and UNICEF.

One approach to it, to which increasing attention has been given, is by increasing the consumption of milk and milk products, to which reference has already been made. Another is through the introduction of new foodstuffs into the diets in areas where milk production is not feasible. Fish flour is one such product; others are soya flour and its derivative, soya milk. In many areas the problem is not so much one of availability of such new foods as persuading people to eat them. Here the work of FAO's home economists is important and recently there

has been a remarkable increase in requests for assistance in this field. In other countries FAO has helped establish fundamental nutrition services, and the setting up of central research institutes, as well as the promotion of dietary surveys. The first major FAO publication, in fact, was the World Food Survey of 1947, which was followed by a similar but more detailed survey in 1952.

Publications

In fulfilling its obligations to member countries, FAO operates not only as a technical advisory centre, but also as a very large publishing house. Normally, all publications have to be put out in the three 'official' languages, English, French and Spanish, resulting in a work load of over 8 million words a year in editing alone. Some of this goes into periodicals, such as the monthly *Plant Protection Bulletin*, known to many readers of WORLD CROPS, the statistical publications already mentioned, *Unasylva* (a monthly world forestry review), the *FAO Fisheries Bulletin* (quarterly) and *World Fisheries Abstracts* (bi-monthly), and *Food and Agricultural Legislation* (quarterly). Most of the other publications are, as it were, the end-products of projects in the regular programme (the final reports of ETAP experts are not printed and not normally available) and consequently cover the whole range of FAO's operations. In addition, there are each year one or two publications of a more general nature, such as the short *Agriculture in the World Economy* (1956), the annual *State of Food and Agriculture* and reports, issued almost every year, on the work of FAO under the regular and technical assistance programmes.

This big publishing programme, running to several hundred separate issues every year, is only one of the ways in which results of FAO's work are made available to member countries. Other ways are through technical meetings, through regional conferences, through the regional offices of FAO, and through the special representatives in many countries where ETAP operates. The regional offices, situated in Washington, Cairo, Bangkok, Mexico City, Santiago and Rio de Janeiro, have their own specialists in various fields, and there are also liaison offices in Geneva and at UN Headquarters. Close contact with these offices and with the field missions is maintained by central liaison services, and lately there has been, in the planning of FAO's work, increased emphasis on integration, not only as between the regions and the field, and headquarters, but also between the regular and technical assistance programmes. For example, the big ETAP fellowship programme, whereby technicians are sent for study abroad to enable them to continue when experts' assignments terminate, is now reinforced by a high-level research fellowship programme, financed from the regular budget. In this way increasingly more efficient use is made of funds which, though they have expanded steadily over the years, are still the real limiting factor in FAO's work.

Trainees of the FAO Agricultural Statistical Sampling Centre in Thailand weigh each bundle of rice and record the result for use in determining accurate yield of plot

Linseed is Profitable

Australian wheat farmers in the northern districts of New South Wales have proved by experience over the last few years that linseed is a more profitable crop than wheat or oats.

Linseed oil, used extensively in the manufacture of paints, varnishes, linoleum, oil-cloth and printer's ink, was formerly mostly imported to Australia at high cost, but now there is a good supply from locally grown crops. The presscake, or meal, remaining after the oil has been extracted from the crushed and partly cooked seed is a valuable supplementary stock food with a high protein content.

Linseed gives favourable economic returns compared with wheat, yields ranging from 12 to 26 bushels of 56-lb. weight. A guaranteed price for the crop is determined by the Linseed Crushers' Association before the crop is sown.

New Irrigation Scheme

An irrigation settlement for Africans which will be more than twice the size of Nyanyadzi, the first and biggest of the nine native irrigation areas in Manicaland, is being developed on the eastern border in the northern part of the Inyanga district. Men of the Southern Rhodesia Irrigation Department are at work on a canal project which will mingle the waters of two streams to irrigate 2,500 acres of frost-free land where crops can be grown all the year round as at Nyanyadzi. Nyanyadzi is more than 700 acres in extent and supports about 200 families. The new irrigation settlement will carry 500 families. The settlement will be in the Nyamaropa reserve in an area at present sparsely inhabited on the banks of the Gaerezi River, which forms the boundary between Southern Rhodesia and Portuguese East Africa in this region.

COMMONWEALTH AGRICULTURAL BUREAUX ORGANISATION

SIR HERBERT HOWARD

(*Secretary, Commonwealth Agricultural Bureaux*)

The Commonwealth Agricultural Bureaux and related Institutes contribute greatly to the assistance of scientists and research workers in agriculture and forestry throughout the world. The organisation has two basic principles on which it operates. First, the bureau for each subject is situated at a research centre doing active work in the subject of that bureau; and, secondly, the collection and dissemination of information, which is an important part of the organisation's work, is carried out mostly by scientists trained in the subject in which the bureau gives information.

THE conception of the Commonwealth Agricultural Bureaux arose from the findings of the Imperial Agricultural Research Conference of 1927. This conference, among other things, recommended the establishment of eight bureaux in eight selected branches in agricultural science.

History

In 1928 the Commonwealth Governments appointed an organising committee to define the functions of these bureaux and to advise on their location, the cost, the sharing of the cost between the different countries and laid down plans for their administration. Underlying the whole was the principle that each contributing country had an exactly equal share in the administration and control and none was in any way subordinate to any other. This was in accordance with the principles of the status resolution of the Imperial Conference of 1926, which, speaking of the self-governing communities, said, ' they are autonomous communities within the British Empire equal in status, in no way subordinate one to another in any aspect of their domestic or external affairs '. The Commonwealth Agricultural Bureaux Organisation is something set up and controlled by the countries of the Commonwealth acting together for a given purpose.

This organising committee produced a document called ' The Scheme ', which, in addition to the various matters mentioned above, advised that the administration of the organisation should be in the hands of an Executive Council. This Executive Council came into being on 1 April, 1929, and the eight bureaux were opened during the year 1929–30. Therefore 1 April, 1929, can be regarded as the official birthday of the Commonwealth Agricultural Bureaux, so that the organisation has now been in existence for over a quarter of a century.

Mr. J. E. C. Coventry, B.A., M.SC., *Chairman of the Executive Council of the Commonwealth Agricultural Bureaux. He is also the scientific liaison officer of the Federation of Rhodesia and Nyasaland*

There are, however, two older bureaux, now called institutes, namely, the Institute of Entomology and the Mycological Institute.

In 1909 an Entomological Research Committee for tropical Africa was set up. The funds of this co-operative venture were provided by the African colonies and the U.K., and it financed the first systematic collection and study of insects injurious to men, animals and crops in East and West Africa. After discussion at an Imperial Conference in 1911 the Institute of Entomology was set up

(i) for the identification of injurious insects;

(ii) to issue a monthly periodical summarising current literature, British and foreign.

In January 1913 the *Review of Applied Entomology* appeared and is now in its 44th year. This Institute of Entomology was the prototype of the institutes and bureaux of today.

After the approval of the Imperial Conference of 1918 a similar Mycological Institute was started in 1920. The *Review of Applied Mycology* first appeared in 1922.

To return to the Commonwealth Agricultural Bureaux Organisation set up in 1929. This is administered by the Executive Council, each contributing country having one seat on the Council irrespective of the amount of contribution, thus carrying out exactly the idea of ' equal in status, in no way subordinate one to another '. This Executive Council is not under any Ministry of any government, but through its individual members is responsible directly and equally to all governments. It is not a corporate body and governments are not contributing to some outside body known as the Executive Council.

As a result of the recommendations of the Imperial Committee of Economic Consultation and Co-operation in 1933, the Institutes of Entomology and Mycology were also brought under the control of the Executive Council, together with the Parasite Service, which had been founded in 1927 as an offshoot of the Institute of Entomology. This 1933 committee, usually known as the Skelton Committee, enunciated, among other things, that the Commonwealth Agricultural Bureaux must have a guaranteed income for a period of years and, what directly followed from that, that Commonwealth Conferences should periodically review the work of the organisation.

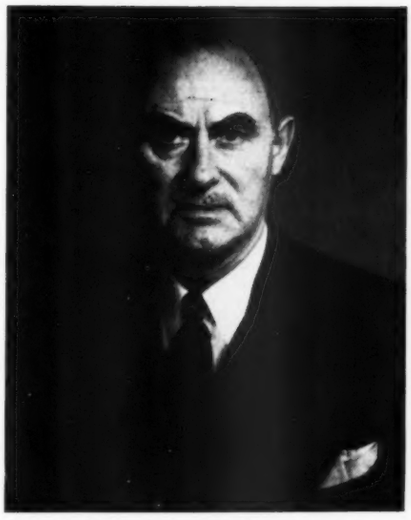
The first of these Review Conferences took place in 1936 and recommended the addition of two more bureaux to the original eight. A Review Conference should have assembled in 1941, but, owing to the war, this was not possible. A committee was appointed under the Rt. Hon. Lord Hankey to review the work of the institutes and bureaux and issued its report in 1943.

The next Review Conference met in 1946. Among other things, it recommended the changing of the name of the Parasite Service, which had proceeded to Canada in 1940, to that of the Bureau of Biological Control and, under a recommendation of the 1950 Review Conference, it is now known as the Institute of Biological Control. It also filled certain gaps in the information by allotting the subject of field crops to the Bureau of Pastures and Forage Crops, the name of which was changed in consequence to the Bureau of Pastures and Field Crops.

A further Review Conference met in 1950. Its recommendations were published in Command Paper 8167.

With a body already a quarter of a century old, the 1950 Review Conference was naturally concerned with consolidating rather than new developments. It did, however, lay special stress on (*a*) the need to continue the service; (*b*) the mutual advantage of co-operation with international bodies especially to avoid duplication; (*c*) the possibility of foreign governments being associated with C.A.B.; (*d*) the desirability of extending the services of biological control to foreign countries.

A new Bureau of Agricultural Economics was recommended, but for various reasons has not yet been set up.



Sir Herbert Howard, Secretary, Commonwealth Agricultural Bureaux

In 1939 a collection of South American potatoes was made. This was housed at Cambridge and the Commonwealth Agricultural Bureaux made taxonomic descriptions and chromosome counts of the material collected. It also undertook certain preliminary breeding tests, examined the character of the material, for example, liability to and resistance to various types of disease, reaction to frost and drought, to photoperiodism etc.

The stage having been reached when the collection should be used for more practical breeding research than falls within the field of the Commonwealth Agricultural Bureaux, the collection was handed over to the Agricultural Research Council on 1 April, 1951. The material resulting from the work will still be available for plant breeders throughout the Commonwealth.

The last Review Conference met in 1955. Apart from repeating the above points under (*a*), (*b*), (*c*) and (*d*), it dealt mostly with the general work and running of the institutes and bureaux.

Other points were: (*a*) the expansion of the Bureau of Agricultural Parasitology (Helminthology) to include taxonomic and identification services and change of its name to the Bureau of Helminthology; (*b*) it changed the name of the Bureau of Dairy Science to the Bureau of Dairy Science and Technology; (*c*) it changed the name of the Bureau of Soil Science to the Bureau of Soils; (*d*) it approved a grant to the National Institute of Agricultural Engineering to facilitate its abstracting work.

Present organisation

The whole organisation now consists of the Institute of Entomology, the Mycological Institute, the Institute of Biological Control, and the 10 Information Bureaux of Helminthology, Animal Breeding and Genetics, Animal Health, Animal Nutrition, Dairy Science and Technology, Forestry, Horticulture and Plantation Crops, Pastures and Field Crops, Plant Breeding and Genetics and Soils.

Work

The institutes and bureaux act as effective clearing houses of information for scientists and research workers in agriculture and forestry throughout the Commonwealth and, increasingly, throughout the world. In addition, the institutes and now the Bureau of Helminthology have their special function of identification and the Institute of Biological Control undertakes its special work of collection of suitable predators and parasites, and shipping them where they are needed to control pests and epidemics.

The organisation has two basic principles which are different from those of some other information services:

(*a*) The bureau for each subject is situated at a research centre doing active work in the subject of that bureau. This is to keep the workers alive and to prevent general stagnation. With the same object in view, the head of the parent institute is usually made the consultant director of the bureau.

(*b*) The collection and dissemination of the information must be done mostly by scientists trained in the subject in which the bureau gives information. This is especially true of the director and assistant director.

In practice the information is collected by the scanning and indexing of a large number of journals in the subject in all languages, by scanning other abstracts and by generally keeping in touch with research in progress. To give some idea of the volume of work concerned, a bureau may scan as many as 500 or 600 periodicals and

800 to 1,000 serial publications in a year, which works out at an average of 20 to 30 publications a day. The information is disseminated by the regular production of 14 properly indexed abstract journals, usually with a review or leading article dealing with some particular aspect of the subject, by the issue of monographs on some particular subject and by answering inquiries. Further help is given by putting scientists in touch with each other, by giving information about research centres, by arranging the exchange of experimental material, by giving information on post-graduate study etc.

In order further to keep a bureau in touch with its scientific audience overseas, each contributing country appoints for each bureau what are called official correspondents. These keep directors of bureaux in touch with work in other countries and act as the ' general friend ' of the bureau in that country. They are, in fact, the scientific link overseas. Some bureaux also appoint what are called foreign correspondents. Each institute and bureau also has a correspondent in the Food and Agriculture Organisation of the United Nations.

In addition to the scientific link of the official correspondents, there is also an administrative link, made by the appointment of a liaison officer in each country overseas, who is really the official correspondent of headquarters.

Administration

The Executive Council is the administrative and policy-forming body within the general programme laid down by the original scheme and various Review Conferences after approval of governments. The Council meets frequently and its decisions are communicated by each member to his own government. The Council has full and complete control of all staff. They appoint the secretary, who is the chief executive officer. The Headquarters Office and Central Sales are both situated at Farnham House, Farnham Royal, near Slough, England. The directors are the heads of each individual institute or bureau and the head of the parent institution at which a bureau is stationed is usually the consultant director for that bureau. These consultant directors form a standing scientific committee to advise the Executive Council in scientific matters. Official correspondents are scientists in contributing countries who deal on technical matters with the directors of bureaux, and the liaison officers are the equivalent of the official correspondents for direct dealings with the secretary on matters not requiring reference to governments through members of Council.

Finance

Money necessary to support the organisation is contributed in an agreed proportion from the various contributing countries. For practicable purposes, the only income which the organisation possesses is receipts from the sales of publications and these contributions.

At each Review Conference the contributions which are necessary for the next quinquennium are calculated. The average annual expenditure is first estimated and from that is deducted the average yearly receipts from sales. What remains is the average yearly contribution required. A modification introduced by the 1950 Review Conference was that only *half* the receipts from sales, plus any excess reserves built up, should be deducted from the estimated expenditure. At the 1955 Review Conference the full receipts from sales plus any excess reserves were again deducted from the estimated expenditure.

In whatever way the receipts from sales are estimated, that amount is deducted from the estimated annual expenditure and the balance is contributed by the countries concerned in the agreed proportion.

During the quinquennium which will start on 31 March, 1957, the total estimate of expenditure for the four funds, *i.e.* the three institutes and the 10 bureaux, is £366,227, out of which £295,611 will come from contributions. These estimates were made before the salary rises as a result of the Royal Commission recommendations.

Publications

Publications are sold, but obviously at a cost far below their real cost of production. Although contributing countries receive a certain number of free copies of the journals, based, at their own wish, on a quota system, they pay for any copies over and above this quota. With the method of calculating the contributions by deducting estimated receipts from sales from total estimated expenditure, it is necessary to have some sort of quota for the free copies issued to contributing countries and that they should pay for copies over and above that quota. A certain number of free copies of journals are given elsewhere for some definite purpose and a certain number of copies are exchanged, but every free copy of this sort tends to upset the budget estimates and the number is, therefore, kept as low as possible. There are no free copies of publications other than published journals even to contributing countries, except a very few sent to copyright libraries for review and so on.

Although this is a Commonwealth organisation supported and paid for by the Commonwealth, it will be noted that its work covers the international field of literature. To all intents and purposes it is international and foreign countries can benefit equally by the services provided by buying the journals and other publications.

Technical News

Paint Manufacture for December includes articles on ' The Hiding Power of White Pigments ', ' New Polymerisation Applications of Rosin ' and ' Blooming of Varnish Films '.

The December issue of *Dairy Engineering* contains articles on ' Ozone in the Dairy Industry ', by D. J. Saxby, ' The Dairy Industry in Brazil —II ' by Prof. J. A. Ribeiro and 'A New Phage-resistant Starter Medium for Cheese Manufacture '.

Included in *Petroleum* for December are articles on ' The Influence of the Second Five-year Plan on the Indian Petroleum Industry ', ' The Search for Oil in Australia ', ' Thermal Polymerisation of Ethylene ' and ' Infra-red-absorption Analysis in the Petroleum Industry '.

The contents of the December issue of *Corrosion Technology* include ' Protecting Steelwork from Rust ', 'A New Hot-dip Galvanizing Plant ' and ' Basic Studies into the Corrosion Resistance of Aluminium Alloys '.

The December issue of *Food Manufacture* includes articles on ' Electronically Controlled Coffee Production ' and ' Trace Elements in Food '.

THE U.S. DEPARTMENT OF AGRICULTURE

(Prepared by members of the Staff of the U.S. Department of Agriculture)

The U.S. Department of Agriculture grew directly out of the Patent Office, which was established on 10 April, 1790. During the 1830s the newly reorganised Patent Office, then in the State Department, undertook to distribute seeds and collect agricultural statistics. Out of these activities developed the basis for a separate agency devoted exclusively to the interests of agriculture. On 15 May, 1862, Abraham Lincoln signed the Bill establishing what is now the U.S. Department of Agriculture as a separate agency with bureau status, headed by a commissioner of its own. On 9 February, 1889, the Department was raised to Cabinet rank and its supervising officer automatically became the Secretary of Agriculture.

ONE of the potent factors in the transformation of American agriculture has been the programmes, education and services provided by the U.S. Department of Agriculture.

There are the Department scientists who work continually to discover effective means of controlling and eliminating destructive plant and animal diseases and insects. Other scientists are seeking improved strains through selection and breeding as a means of increasing crop and livestock yields. More efficient feeding and management are goals of still other Department scientists. At the same time, researchers are seeking out new uses and expanded markets for American crops and livestock products.

Technicians of the Department work with farmers and ranchers in developing soil- and water-conserving practices and programmes.

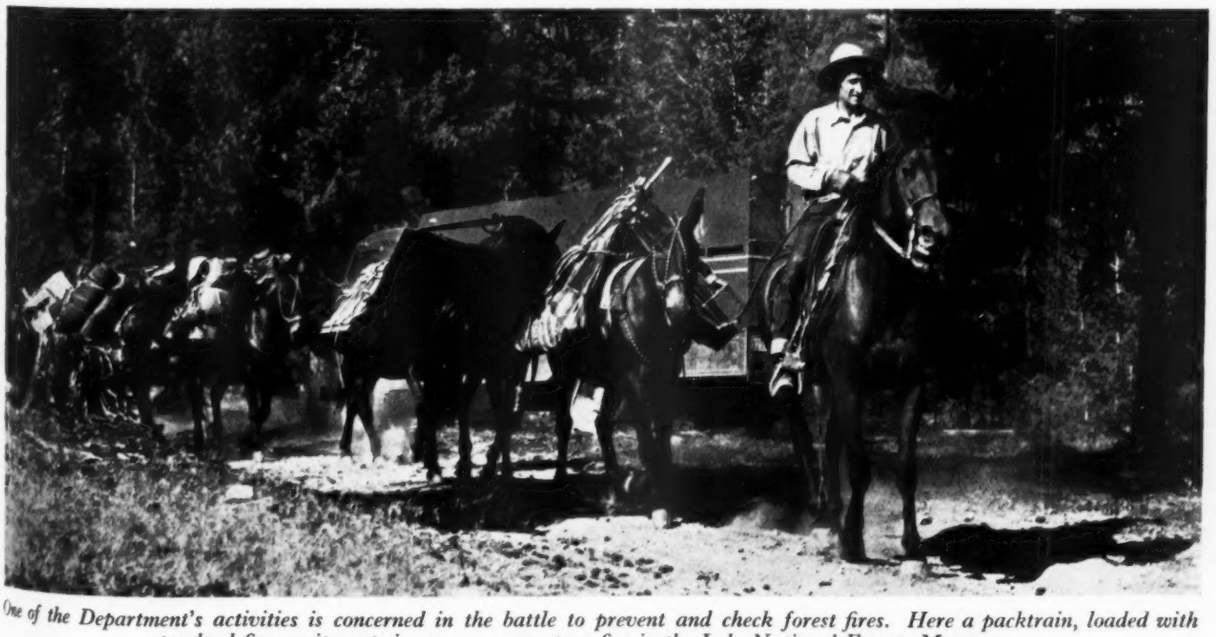
Through land-grant colleges and universities and the co-operative extension services the Department aids in providing farmers with information on better farming methods.

Through market reports released to the press, radio and television, farmers are kept currently informed on market conditions. Research, regulations, grading and inspection are among other marketing services provided by the Department to aid farmers and protect the public.

This by no means exhausts the accounting of the many services provided by the Department, which extend from a home demonstration agent's teaching a housewife how to make a child's coat to the marketing of a million bales of cotton for export.

Transformation

The significance of the transformation in American agriculture is highlighted in these statistics:



One of the Department's activities is concerned in the battle to prevent and check forest fires. Here a packtrain, loaded with standard fire equipment, is seen en route *to a fire in the Lolo National Forest, Montana*

Since 1940 the U.S. population has increased from 132 millions to 168 millions, some 27%.

Since 1940, despite no increase in acres cropped, U.S. farm production has increased 35%.

In 1955 American farmers obtained the highest average yields in the history of the country from the smallest acreage in crops since 1940.

Production per man-hour in agriculture has more than doubled in the past two decades. In part this was the result of mechanisation. The bulk of this increased production and greater efficiency was due, however, to research and the rapid adoption of new technological and scientific development.

This rapid adoption, in turn, was possible because farmers have had the means, through fair prices and reasonable credit, to put the better methods of farming into operation.

How the U.S. Department of Agriculture, a Government agency, has contributed to and been a part of this tremendous agricultural advancement is an example of democracy in action.

Creation of U.S.D.A.

The U.S. Department of Agriculture was created by an Act of the Congress of the U.S.A. which was approved by President Abraham Lincoln, 15 May, 1862.

The Act creating the Department begins with this important paragraph:

' Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that there is hereby established at the seat of Government of the United States a Department of Agriculture, the general designs and duties of which shall be to acquire and to diffuse among the people of the United States useful information on subjects connected with agriculture in the most general and comprehensive sense of the word, and to procure, propagate and distribute among the people new and valuable seeds and plants '.

Requirements increase

Although these primary purposes are still major responsibilities of the Department, the growth of the nation and the complexities of a modern agriculture have increased the needs and demands for increased services.

From the creation of the Department in 1862 until 1889 administration

Ezra Taft Benson, U.S. Secretary of Agriculture, was born in Idaho in 1889. His parents were among the pioneer settlers of Southern Idaho

was by a Commissioner of Agriculture. Isaac Newton, the first Commissioner, was limited in his activities both by lack of funds and personnel.

An increased staff, a building in which to house the Department, an experiment farm and other facilities were added as the demand for increased service grew.

Following a deluge of petitions and memorials, extending over several sessions of Congress, the Department was given Cabinet status and Commissioner of Agriculture Norman J. Colman became Secretary of Agriculture Colman and a member of the President's Cabinet.

Realisation that farmers could no more leave ' worn-out land ' and move to virgin soil ' out West ' led to movements to conserve the nation's soil and water resources. Seeing forests depleted and wild life dwindling led to the creation of a Forest Service. Disparity of farm prices and depression led to legislation aimed at safeguarding the agricultural economy.

The responsibility of the Department increased as Congress passed Act after Act to promote the welfare of agriculture. In a sense the Department of today, with its wide-flung and varied activities, is but a reflection of the American ideal that ' we, the people of the United States', are the sovereigns of this land and that the Government derives all its authority from the citizens of the country.

Concomitant with this ideal is the realisation, learned largely through experience, that there are certain functions and activities which require Government administration or assistance. Studies in the feeding of dairy cows, which provide farmers with new ' know how ', marketing standards and regulations and their enforcement, technical and financial assistance to farmers as a means of conserving soil and water—the source of the nation's future food supply—are among these.

Functions

Today the U.S. Department of Agriculture's functions include:

Research.—Agricultural research has transformed American farming in the brief space of a lifetime. At the research centre at Beltsville, four large regional and other laboratories, State Agricultural Experiment Stations and numerous other stations and experiment farms, Department scientists are pushing out the circle of human knowledge. To the farmer—and to all of us—this has meant new varieties of field crops and fruits that yield more and thrive better; superior breeds and livestock; improved feeds; more effective control of insects and disease and more intelligent and purposeful use of soils, water and forests; improved methods of processing and marketing; more efficient distribution and better foods and fibre products for consumers. For the home-maker it has meant better knowledge of the nutritive value of foods; better methods of preparing and preserving food; labour-saving household equipment; and more serviceable fabrics and clothing.

Education.—Through co-operation with State land-grant colleges and universities, the work of county agricultural extension agents, soil conservation districts, county agricultural conservation and stabilisation committees, Forest Service employees, Farmers Home Administration supervisors, and others working with farmers, the proven results of research are being diffused to the men and women who live on our more than five million farms.

Marketing.—The Department helps to develop improved marketing methods and to expand markets—both domestic and foreign—for farm pro-

ducts; maintains a market news service on livestock and all major crops; administers regulatory measures to prevent fraud and waste in marketing; and helps to establish and maintain market standards for agricultural commodities.

Price stabilisation and crop adjustment.—The Department is responsible for price-support programmes on designated commodities, determining parity—or a fair exchange value—and for administering such crop adjustment measures as the new Soil Bank, acreage allotments and marketing quotas.

Credit.—Another responsibility delegated to the Department is that of providing farmers with essential credit for the production of crops, to meet emergencies, protect farm prices and improve their farms. Credit provided through the Department has encouraged extension of electrical and telephone services to rural areas through long-term loans to local business enterprises.

Crop insurance.—Crop insurance is provided to protect farmers against the disasters of floods, frost, hail, fire, epidemics of disease or insects and other forces which may result in widespread or complete destruction of a crop.

Farmer co-operatives.—Congress has directed the Department to help farmers build stronger business organisations as a means of meeting both buying and marketing problems. As an agency of the Department, the Farmer Co-operative Service is a co-ordinating centre for research in the field of agricultural co-operation.

Conservation. — Through technical assistance and cost-sharing, the Department aids farmers in protecting and building soil resources and in making better use of water and timber.

Forest resources.—The Department is responsible for protecting and managing the timber, water, forage, recreation and wild life resources of the national forests. In co-operation with the states, it also promotes better protection and management of forests on private lands.

Photos: U.S.D.A.

Dr. Maurice Fried, soil scientist, carefully weighs a small quantity of superphosphate tagged with radioactive phosphate and places it in a glass container. Radioactive tracer methods are used to determine how plants use nutrients in the soil

Slippage Can Cost Power

A quarter of the horse-power hours you should be getting out of your tractor can be lost through slippage. It also leads to fuel waste and causes unnecessary wear on tyres. And slippage may be much more.

In a Nebraska (U.S.A.) demonstration there was 70% more slippage on a tractor without wheel weights than on an identical tractor with three 100-lb. wheel weights.

Both tractors were pulling a 1,500-lb. load in fourth gear under exactly the same tillage conditions. The weighted tractor travelled 11,300 ft. on a gallon of fuel; the unweighted one covered only about half that distance—6,230 ft.

Weights

G. W. Steinbruegge, agricultural engineer in charge of the demonstration, said you could expect wheel weights to reduce slippage 15 to 25% on firmer wheat stubble land.

Contrary to common belief, under ordinary field conditions slippage occurs between soil particles and not between tractor tyres and the ground.

Quinoa for Greenland

An experiment in the cultivation of quinoa, a hardy plant whose seeds and leaves have long been eaten by the upland natives of Peru, Bolivia and Ecuador, is to be undertaken in Greenland under the auspices of the U.S. Navy, according to a report from the National Geographic Society. In Peru and Bolivia quinoa has been grown with good results at altitudes up to 13,000 ft. If the experiment in Greenland is successful, a new staple food will have been introduced for the country's rapidly expanding population.

To Authors and Readers

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ROLE OF THE NATIONAL INSTITUTE OF AGRICULTURAL ENGINEERING

E. HARRIS

(*National Institute of Agricultural Engineering*)

The introduction of mechanical equipment has brought about important changes in farming, enabling large tracts of land to be brought under cultivation for the first time, improving fertility, controlling erosion, increasing labour productivity, reducing hand labour and effort, and generally changing the social and economic pattern of the countryside. More and better equipment is, however, needed in view of the increasing labour shortage in some countries, higher living standards, growing populations and inadequate food production. The National Institute of Agricultural Engineering (N.I.A.E.) is playing an important part in advancing agricultural engineering science.

THE N.I.A.E. was set up by the British Ministry of Agriculture and Fisheries in 1942 to replace the Institute for Research in Agricultural Engineering, which was founded in 1923 at the University of Oxford. In 1948 it moved from Askham Bryan, Yorkshire, to Bedfordshire, where its activities were rapidly expanded to include a wide range of aspects of the application of engineering to both agriculture and horticulture. In 1949 it was taken over by the British Society for Research in Agricultural Engineering under the aegis of the Agricultural Research Council. A Scottish station was also established in Midlothian to test machines under Scottish conditions.

Machinery testing

One of the most important activities of the Institute is the testing of tractors and other farm machinery, except dairy equipment. Submission for testing is voluntary and the test reports are published only with the consent of the test entrant. This is unlike the practice in certain other countries, but has the advantage that manufacturers are able to enter machines for testing at an early stage in development and that any modifications needed can be made to the prototype before the machine is put on the market. This eliminates a great deal of trial and error at the expense of the user and places facilities at the disposal of manufacturers which may not otherwise be available.

Tractors may either be tested in accordance with British Standard 1744: 1951, which provides only for belt, drawbar and fuel consumption tests, or the full test may be carried out, which includes ploughing on various types of soil, drawbar-pull tests on different surfaces and gradient tests. Facilities are provided for testing tractors under a very dusty atmosphere and radiant heat, as encountered in some tropical countries. In some cases the behaviour of a given model of tractor, when working under practical conditions on farms of different type and locality, is studied over a period. Records are kept of the number of operational hours per year, fuel and oil consumption, repairs and replacements, the type of operations carried out etc. to assess the performance of the tractor under normal working conditions and when handled and maintained by ordinary farm labour. These farm trials are meant to supplement the normal tractor test and should be particularly interesting to farmers.

Farm machinery is also tested mainly under normal working conditions in the field, for which purpose use is made not only of the land available at the Institute, but also of a number of selected farms, to ensure that the machine works under as many different crop and ground conditions as possible. The type of produce to be handled by

Fig. 1. Plot combine-harvester with endless-belt threshing mechanism

a machine is also varied to cover a range representative of that encountered in practice and the test procedure is discussed with the manufacturers.

Wear-testing technique

In view of the great heterogeneity of ground, weather and crop conditions, local requirements, varieties and operator's skill, it is very difficult to test farm machinery, especially field equipment, under repeatable conditions so that the results are comparable. A great deal of work and thought is being put into developing test procedures for individual types of machine to enable testing under as near as possible repeatable conditions. For obvious reasons, there are many practical difficulties in achieving this and fundamental or applied research is often needed to assess, for example, which factors are of practical importance and to what extent, how the condition of the crop or soil may be denoted in scientific terms, under what procedure the test should be conducted to substitute as far as possible accurate measurement for subjective judgment etc. For practical reasons, mainly because the season is relatively short for most crops, all the field work of a machine has to be carried out over a short period and this does not normally permit the assessment of the rate of wear and durability of components. A laboratory technique of accelerated wear testing is being sought which would produce the same results as prolonged operation in the field. Detailed test procedures have been worked out for a number of machines and testing will be carried out accordingly.

New equipment

The technique studies are closely linked with the development of suitable apparatus and great attention is being devoted to instrumentation and to frequent calibration of the equipment used. But suitable apparatus and techniques must often be developed also for general experimental work. This applies not only to the requirements of the N.I.A.E., but also to those of other agricultural research establishments, to enable them to carry out research in their particular field. For example, a combine-harvester has been constructed to permit harvesting of small experimental plots, where manœuvrability and ease of cleaning were the chief requirements. The machine

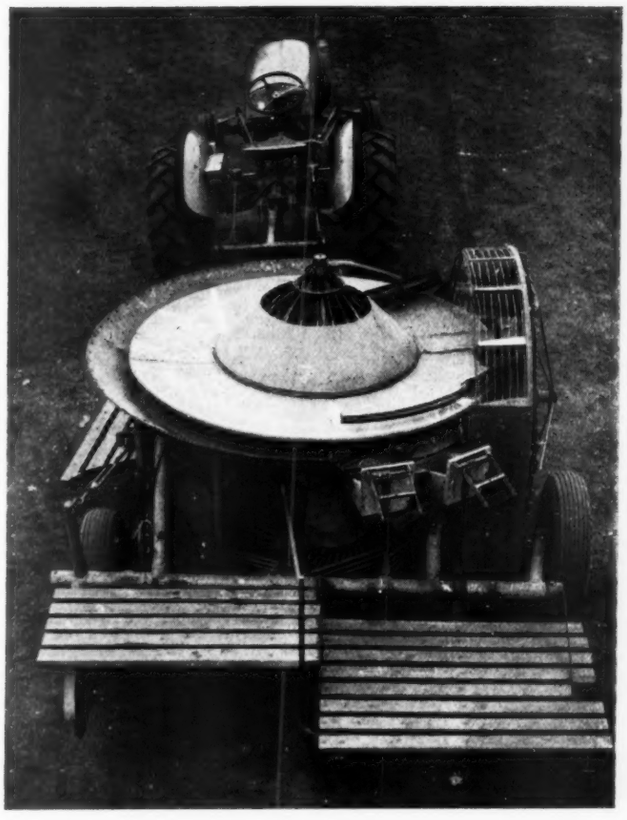


Fig. 2. Prototype potato harvester, which incorporates a plough disk for lifting the ridge

(Fig. 1) was first mounted on the tractor and incorporated an endless-belt threshing mechanism in place of the conventional drum. Its cutter bar was in two sections reciprocating in opposite directions to reduce vibration. A self-propelled version, including the same basic features, has been developed from this. Other examples of this kind of work are: a small cutter for taking grass samples, a soil grinder to speed up analysis, equipment for fertiliser placement, a plot irrigator ensuring uniform distribution of measured quantities of water over a given area, a washing machine to remove aphides from lettuce, and a drill for cereal plots. Apart from test rigs, such as a 'treadmill' for the testing of tractors, equipment for duration testing of a sprayer hand-pump and a spray-boom oscillator, and an assembly for the testing of seed drills and fertiliser distributors; special equipmen has also been developed for the weighing of windrows and of pikes to determine the rate of drying, for the assessment of the uniformity of depth of ploughing, for the weighing of trailers in the field, for loading tractors under test up to a maximum of 10,000 lb. in bottom gear and 5,500 lb. in top gear, for measuring the slip and tractive effort transmitted by a given wheel etc.

Grain drying

Most of the research work is into practical problems encountered in British and overseas agriculture. For example, the widespread introduction of combine - harvesting necessitated research into the farm drying of grain in ventilated bins and on platform driers. Drying of grain in cylindrical silos of wire mesh or expanded metal, having a central perforated air duct for lateral ventilation, is being investigated and a prototype counterflow drier has been developed. Cleaning of the sample coming from the combine-harvesters still presents a problem on some farms and an experimental cleaner has been constructed. Work is also proceeding on heating methods, in particular on heat exchangers, oil firing, the use of indigenous fuels etc. Several representative methods of measuring the moisture content of grain have been compared to assess their respective merits; moisture determination in forage crops, groundnut and other crops is also being studied.

Efforts have been made to establish the relationship between the

amount of sunshine, rainfall and other meteorological factors and the moisture content of the grain in the standing crop. By relating this information to the average weather conditions in a given area, farmers may be able to assess the capacity of grain driers, combine-harvesters and transport facilities needed.

In order to investigate the effect of different treatments on mould growth in storage and on viability, grain was combine-harvested at different moisture contents and with various drum speeds and concave settings and stored with and without drying in open-weave sacks and in insulated bins, simulating conditions inside a grain silo. The possibility of storing grain under British conditions in outdoor silos made of four different materials was also examined.

Weather conditions in the U.K. often make it difficult to make hay by the traditional methods. Modern hay-making machines, in particular tractor-driven tedders, speed up the process and crushing and bruising equipment has been used for the same purpose. However, in the absence of artificial drying, good quality hay may be made by drying on racks, tripods and similar devices. But the widespread introduction of this method has been hampered by the fact that it is very labour-consuming, and work at the N.I.A.E. has aimed at mechanising the erection, loading and unloading of racks and to study the comparative rates of drying in pikes, tripods etc. and in the swath. Baling of hay is becoming more popular and means of curing the bales by ventilation in the barn will be investigated.

Root crops

Labour peaks and shortage of casual labour have promoted the study of mechanical methods of thinning beet and suitable down-the-row thinners have been constructed. Quite naturally this work is closely associated with precision drilling, mechanical land levelling and the use of natural or treated seed of different kinds. An experimental drill for sowing turnips or similar crops on the top of the ridge has been developed.

To study the problems of machine harvesting of potatoes, fundamental research was first carried out on various means of raising the potato ridge, of separating the haulm, sifting the soil/tuber mixture, separating stones and clods etc. On the basis of this work, a prototype tractor-drawn potato harvester (Fig. 2) has been developed, which incorporates a plough disk for lifting the ridge, a revolving spider for preliminary sifting, a rubber roller to separate haulm etc., an elevating drum, and a circular rotating picking table from which the tubers are swept by operators into a trough situated between them and the table; the floor of the trough rotates with the table and delivers the tubers to a bagging attachment. Mechanical damage to the tubers still presents a serious problem, which has been investigated by dropping tubers of various size and weight on to different surfaces. Potatoes with various types and severity of damage were stored for definite periods to show the effects of dirt and damage.

Dirt tare also plays an important part in the harvesting of sugar-beet and particularly in clamp storage, where its effect has been investigated.

Soil problems

The physical properties of soil are of great interest to the agricultural engineer in connection with the cleaning of root crops, the transmission of power through wheels, and the resistance to the penetration or displacement of cultivating tools. The latter question has been studied with the aid of a tool of simple geometric design and the forces acting on a plough body in work have been measured by means of strain gauges. Shear strength was found to be of great importance as a measure of soil workability and extensive use is being made in investigational work of the torsional shear box developed by the N.I.A.E. Soil/metal friction has also been studied in order to find the factors involved in the scouring of cultivation tools and their wear.

Questions of soil science are also closely associated with the work on the cultivation of tropical soils. The growing of crops in semi-arid regions appears to be economically possible only if suitable measures can be taken to conserve moisture and prevent soil erosion. This might be achieved by tie-ridging, and various ridging bodies are under investigation to find the pattern that will give a suitable ridge with the lightest draught. Great attention is also being paid to the mechanisation of the harvesting and subsequent treatment of certain crops normally grown overseas, such as sugar-cane, fibre crops, cotton, rice and groundnuts. The experimental groundnut harvester has reached an advanced stage of development and now includes a mechanical conveyor, a rotary cleaning drum for the sample and four interchangeable stripping mechanisms. This harvester, as well as the other equipment for overseas farming, are being tested and partly developed in East Africa and a small testing unit under the direction of the N.I.A.E. is

Fig. 3. Experimental steerage vehicle. Particular attention has been paid to the correct siting of the controls and to unobstructed vision on the tools

Fig. 4. Hydraulic tractor with experimental potato digger. The tractor has no mechanical transmission, clutch or brakes

to be set up at Eldoret, Kenya; it will test tractors and implements under local conditions in various parts of East Africa. A great deal of the work on irrigation, spraying and tractors will also be of benefit to overseas agriculture.

Horticultural machinery

This applies in particular to spraying, where recent advances in low-volume and drift spraying may lead to the more widespread introduction of spraying equipment in overseas territories, especially for locust control. Work at the N.I.A.E. is mainly concentrated on the assessment of droplet size and distribution as obtained with different types of nozzle, and the development of suitable low-pressure air-blast nozzles. Techniques have been devised for recovering, sizing and counting spray deposits and an electronic analyser has been constructed.

Trickle irrigation equipment has been installed in the experimental glasshouse at the N.I.A.E. Some difficulties have been encountered with this equipment because of insufficient spread of water in the ground, the presence of mucus-forming bacteria in the PVC tubing and nozzle blockage. Consequently the use of low-level sprinkling equipment is to be investigated in several glasshouses as an alternative method of watering, particularly for tomatoes. For purposes of mist propagation of cuttings an 'artificial leaf' has been developed which automatically actuates the intermittent mist sprayer when the absence or presence of moisture indicate the need or otherwise of further spraying. A high-speed hot-water system has been installed for the heating of glasshouses, and experiments on heating systems are proceeding at various horticultural experimental stations. The amount of incoming radiation, heat distribution, humidity, carbon dioxide content, temperature and other factors affecting plant growth in glasshouses are being studied, the evapo-transpiration rates being measured by raising crops in a weighing machine. The study of steam-sterilising techniques is likely to promote the use of suitable equipment and to effect fuel savings.

Row crops

There is a certain amount of interest amongst growers in the prepacking of fruit and vegetables. Some work has been carried out on the development of vegetable-washing machines and the present version incorporates a vibrating filter screen for the extraction of solids from the water. Another rather specialised problem is that of lifting bulbs by mechanical means. In this case the aim was to design a device which could be used with existing machinery and the equipment devised is attached to a trailed plough and lifts the bulbs from the inverted furrow slice.

A great deal of labour could be saved if it were possible to hoe row crops accurately and close to the row. This can only be achieved if tractors are designed in a way to permit unobstructed vision on to the tools, one-man control and accurate steering without undue fatigue. It will be possible to study this problem further by means of a specially constructed steerage vehicle (Fig. 3), in which particular attention has been paid to the correct siting of the controls, the provision of a comfortable seat, and to unobstructed vision on the tools.

Future developments

It is only to be expected that the Institute devotes its attention not only to the urgent problems of the present, but that it looks to the future in an effort to improve the equipment used on farms. The social and economic pattern of farming is changing rapidly, both in the more under-developed countries and in the highly industrialised countries. Moreover, great advances are made in other sciences, which may have a considerable impact on agricultural engineering. This applies not only to the introduction of new or improved materials, notably plastics, artificial rubber, stainless steel, fuels etc., but also to new concepts in prime movers and power transmissions. An example of this is the application of hydrostatic transmission to agricultural tractors. A prototype tractor incorporating this feature has been developed at the N.I.A.E. and is being tested in practical work (Fig. 4). The tractor incorporates two hydraulic wheel motors with five cylinders each, to which oil under pressure is supplied from a piston pump driven by a conventional diesel engine. It has no mechanical transmission, clutch or brakes, the direction and speed of motion being controlled by a single lever, which regulates the oil flow. This simple control may be useful where unskilled native labour has to be used for driving the tractor and where fatigue is to be minimised, *e.g.* on work that requires the close attention of the driver. The infinitely variable speeds will enable the driver to select the speed most suitable for a given task and it will be possible to carry out accurate hoeing, mechanical thinning and similar tasks more efficiently. This is also made possible by the unobstructed vision of

the driver on mid-mounted tools in the absence of the mechanical transmission. The very low speeds possible and the ability to change quickly from forward to reverse travel and *vice versa* promotes new ideas in the use of machines. Thus the possibility of travelling sufficiently slowly to enable one operator to sort the potatoes dug by a simple machine from one row is being explored (Fig. 4). Similarly, a self-propelled combine-harvester is envisaged which would incorporate two hydraulic wheel motors, an endless-belt threshing mechanism and other novel features.

It will be noted that a great deal of the work of the N.I.A.E. is of a long-term nature and the practical application of its results may not take place for a number of years. But every effort is being made to keep in close touch with manufacturers, research workers and the farming community. Liaison units are maintained at the Institute by the National Agricultural Advisory Service and by the Colonial Office. A large number of requests for information and advice are regularly dealt with and the library and information services are available to the public. Apart from the test reports, which are now also brought out in an abridged version indicating those features of a machine's performance thought to be of particular interest to the user, the Institute publishes reports, technical memoranda, a journal containing original contributions and an abstracts journal.

Through these publications, as well as through visits and personal contacts, a two-way flow of information is maintained between the Institute and those who are to benefit by its work to mutual advantage.

Photos: N.I.A.E.

The 'Supertrac' in Antigua

A Ransomes ' Supertrac ' plough is seen here preparing cambered beds for the cultivation of sugar-cane in Antigua. This share plough, which is the largest in quantity production in the world, has been substantially modified to suit local conditions; instead of the usual four furrows, it works only three, and it is mounted behind a crawler tractor. Cambered beds are a necessity in the West Indies, where adequate drainage must be provided for the rainy season, and trailed implements are too cumbersome in these conditions. Antigua Syndicate Estates Ltd. is the local concern, which, by adding its ingenuity to the skill of British engineers, is helping to improve cultivation of these cane-growing areas.

Ransomes' ' Supertrac ' plough preparing cambered beds for the cultivation of sugar-cane in Antigua

Japan's Agricultural Machinery

Under the Colombo Plan the Government of Japan has given agricultural implements for promoting rice cultivation in Pakistan.

Earlier, a team of four Japanese farmers was sent under the Colombo Plan to East Pakistan and another to West Pakistan to demonstrate the Japanese method of rice cultivation to farmers. The experiments to increase the per-acre yield of rice by the use of Japanese methods have been in progress for the last six months in both the areas of Pakistan and these experiments promise good results.

The machinery supplied by the Government of Japan is meant mainly for use on these experimental farms. His Excellency Mr. Kiyoshi Yamagata, Ambassador Extraordinary and Plenipotentiary of Japan, in a formal ceremony in the Japanese Embassy, handed over this machinery to the Agricultural Development Commissioner, Mr. Mohammad Afzal. Members of the Japanese Embassy, officers of the Ministries of Agriculture and Economic Affairs and two of the Japanese farmers who are at present working on the demonstration farms at Dokri were present in the ceremony.

Rice-growing Projects

The first commercial rice crop in Australia's Northern Territory will be harvested in May 1958 and the company developing the area hopes to market the grain at 2*d.* per lb.

This was stated by Mr. P. Cullen, managing director of Mainguard, an Australian investment company which is providing one-third of the finance for the new project. The company developing the plantations, Territory Rice Ltd., with headquarters in Hollywood, California, expects to reach full development in 10 years.

The first rice crop of the Koembe project has been successfully harvested in Netherlands New Guinea. The Koembe project, which aims at large-scale mechanical cultivation of rice in an area near Merauke, was commenced in 1952, and it is planned to extend the work to cover an area of 30,000 acres in combination with a cattle-raising industry, aiming to provide enough rice and meat for local consumption in Dutch New Guinea.

The Snowy Mountains Scheme

C. M. GRAY, O.B.E., E.D., M.SC., A.M.I.E.(AUST.)

(*Senior Representative, Department of National Development, Commonwealth of Australia*)

The Snowy Mountains Scheme is a gigantic project, which has caught the imagination of the Australians. It has attracted energetic and capable men to the Authority's staff, and now, in 1956, impressive progress has been made towards the attainment of the first major objectives. Even though barely seven years have elapsed since the Authority was constituted, the first power station is already making a substantial contribution towards Australia's needs and, needless to say, the country will benefit tremendously from the large ancillary irrigation scheme.

BY far the largest project in the Australian programme of development works is the Snowy Mountains Scheme. Estimated to cost over £A400 million, it will bring great and enduring benefits, and in war will furnish a source of power likely to be invulnerable to almost any form of attack.

Some account of the place of this project in the Australian economy, and of the background to its conception and construction, is called for in a general account such as this is intended to be, and these aspects are therefore briefly reviewed before attempting to describe the Scheme itself.

The Snowy Mountains Scheme has for its object the exploitation of the potential of the snow and rainfall in part of the Australian Alps to yield both power and water for irrigation. In its ultimate development it will generate hydroelectric power at the rate of 3 million kW. and supply about 2 million acre-ft. of water per annum for irrigation.

This will account for a large slice of Australia's potential for hydroelectric power generation, the total of which is estimated to be between 7 and 10 million kW. Comparing this figure with the potential of some other regions, it can be seen that Australia, at once the driest and flattest of the continents, is not particularly well endowed with water power. However, we must do the best with what we have; and since power generation from falling water depletes no 'wasting assets', there is good reason for developing what *is* there as early as possible.

The Snowy Mountains Scheme has a dual objective. It is worth stressing this point. In the long run it seems probable that water resources will be found to be the principal factor limiting Australia's development, and it is therefore essential to keep water-conservation projects in the van of our works programme.

Results from existing schemes have shown what can be achieved by irrigation. Land in the Murrumbidgee Valley, for example, which 40 years ago carried less than £100,000 of sheep, now yields annually primary produce worth over £10,000,000—and farms which supported a population of 150 before the first world war now support 20,000 people. This is the direct result of irrigation. But the waters of the Murrumbidgee and the Murray—the rivers which are to be augmented through the Snowy Mountains Scheme—have now been committed to a point at which summer flow will not allow of much further extension of irrigation—although there is no lack of plainlands needing only water to develop high fertility.

It is estimated that the additional production made possible by applying the 2 million acre-ft. of Snowy water to irrigation areas will be worth over £25 million per annum.

Power requirements

The speedy growth of Australia's manufacturing industries with an output already worth more than £3,000 million per annum calls ceaselessly for commensurate increase in power generation. The minimum rate of increase in demand to be expected from the present rate of industrial growth will require generating capacity to be doubled every eight or 10 years. This rate of demand increase seems to apply in all progressive countries. But, to be realistic, demand forecasts must also allow for the rate of population increase —which is at present running at the highest rate in history.

Then again, it is probable that consumption of power for domestic purposes will increase. Australia does not stand as high in the scale of *per caput* energy usage as do several other progressive countries and, being a country where conditions are by and large favourable to a high standard of living, additional demand is likely to stem from this circumstance.

Australia has already been made to realise the importance of matching power demands with supply. We entered the 1939–45 war with a substantial reserve of generating capacity, but in the early postwar period the demand arising from our fast developing industries and other sources quickly outstripped the capacity of available generating capacity. A bleak time of 'load-shedding' ensued that brought home to one and all the dependence of almost every activity on electric power supply. Few could now be found to criticise a vigorous policy of building up generating capacity.

Coal reserves

Australia has good reserves of coal, although the deposits are not always

found in the places where we would like them to be. Thermal stations are most efficient if they operate at a steady level, day in and day out, but in practice the loads are very far from constant. Because electricity cannot yet be stored in significant amounts, generators have to be started up, or cut out, to meet large variations in load.

Future aims

The prime role envisaged for the Snowy Mountains Scheme as a power generator is that it should handle peak load for New South Wales and Victoria. Located about midway between main load areas of these two States, it is well placed for this purpose. Nevertheless, the storages which must be provided to take care of seasonal fluctuation in precipitation and to control the natural run-off will be on so large a scale as to admit of the entire complement of generators operating at full output for lengthy periods when once these storages have been filled. Thus in emergency the Scheme will provide a mighty reserve.

Integration of the Snowy Scheme with the thermal power generation systems of Victoria and N.S.W. is already planned. Perhaps in course of time it will also be linked in with the system of South Australia and with Tasmania. But integration on this scale must await further technical developments in the long-distance transmission of electricity—possibly in the direction of high-tension d.c. transmission.

Commonwealth–State co-operation

The Australian Constitution is the principal instrument regulating the activities of the States *vis-à-vis* the Commonwealth Government. The Australian States were administered by sovereign governments long before Federation was achieved, and the Constitution reflects this fact. Each State is responsible for the development of its own resources, which implies that the generation and distribution of power is basically a State matter. But the Commonwealth Government has also certain rights and obligations, arising from the creation of the Australian Capital Territory (the region around and about Canberra), and through its responsibility for defence. Since the Snowy Scheme directly affects three parties—Victoria, N.S.W. and the Commonwealth Government—it is not surprising that special measures were necessary to enable the Scheme to proceed.

When it comes to the point the Commonwealth–State system is fairly flexible, and projects obviously of national importance are hardly likely to be jeopardised by purely procedural difficulties. Preliminary investigations into the Scheme were made by a series of committees on which all three interests were represented, and the plan finally recommended was a joint production. It was then approved in all essentials by the three participating governments.

To carry on the work from this stage a Commonwealth Act—the Snowy Mountains Hydro-Electric Power Act of 1949—vested the responsibility for development and implementation of the scheme in a new body—the Snowy Mountains Hydro-Electric Authority (S.M.H.E.A.). Although the Authority was created by Commonwealth legislation, it grew out of joint Commonwealth and State endeavour and is concerned with a task which is truly of national importance.

First steps

In fact, a final form of agreement seems now to be in sight, but from the start the work has gone on without a pause, guided by the general principles agreed on verbally in July 1949. Everybody—or very nearly everybody—was satisfied about the things that really mattered, so the engineers went ahead with the job, began to spend quite a lot of money, and make outward and visible alterations to the landscape up above cloud level, and the wheels turned faster and faster as the months passed. Large contracts worth tens of millions were advertised, and enterprising firms at home and abroad formed consortiums large enough to tackle the work. Their representatives began to show up on the scene of action and giant machinery moved in. New towns were built and old ones sentenced to vanish, like fabled Lyoness, beneath great waters—and everybody knew quite well that in due course a sensible agreement would be hammered out.

Perhaps this picture makes the path of those charged with the implementation of the Scheme seem to have been rather more smooth than was the case. Certainly there have been critics of the Scheme, who have attacked it in general and in detail. Rebuttal of their arguments has been an exercise of great value in testing the validity of concepts upon which the Scheme is based.

Nuclear energy has moved forward from being just a good probability (read the published appreciations of eminent scientists and engineers of only three years ago—it is a salutary thing to do!) to the stage of actuality during the life of the Snowy Mountains Hydro-Electric Authority. Wisely the Scheme was re-evaluated in the light of this new factor—but no case was found for interfering. The Snowy Scheme goes on!

Snowy Mountains Advisory Council

At this point there should be mentioned a measure taken to assure close and effective consultation between the three governments most affected and the Authority itself pending conclusion of the formal agreement. A Snowy Mountains Advisory Council had always been envisaged. So that the Authority might have the advice and assistance of such a council without undue delay a conference of the responsible Commonwealth and State Ministers decided in April 1953 that the Council should be constituted on an interim basis.

The Chairman of this Interim Council is the Secretary of the Commonwealth Department of National Development and the Deputy Chairman is the Commonwealth Director-General of Works. These two officials represent the Commonwealth Government; New South Wales and Victoria each have two representatives, one of whom is in each case the Chairman or a very senior officer of the Electricity Commission of the State concerned and the other the Chairman or Commissioner of the State organisation responsible for water supply and irrigation. The Authority is represented by the Commissioner, Sir William Hudson. Thus all bodies directly concerned are able to discuss points at issue and co-ordinate their plans when these interlock.

Description of the Scheme

The Snowy Mountains are the highest and most rugged part of the mountain ranges of south-eastern Australia, in turn the most elevated

The Guthega Dam site across the Snowy River in the Snowy Mountains hydroelectric scheme area in the Australian Alps of southern New South Wales. The first power from this area was obtained in 1955

region of the continent. Running north and south for about 100 miles, they attain in Mt. Kosciusko a height of 7,313 ft. They receive heavy and reliable falls of rain and snow. This, conjoined with the steep fall away to lower ground, is favourable to the generation of hydroelectric power.

The natural drainage of the region is *via* the Murray and the Murrumbidgee Rivers to the north, and *via* the Snowy, and its tributary, the Eucumbene, to the south. The northern system flows, in due course, generally westward, meandering across inland plains, ultimately reaching the sea in South Australia.

As already mentioned, these plains need only water to produce abundantly, and all that is available from the Murray and Murrumbidgee is now committed to very successful irrigation projects.

The greater part of the run-off from the Snowy Mountains is taken by the Eucumbene–Snowy. The course of the latter is south, across country already well watered by reliable rains. Consequently this water is practically wasted at present. It must be made to flow inland, and the Snowy Mountains Scheme is based on its diversion through the dividing range into the Murray, and into the Murrumbidgee (*via* its tributary, the Tumut).

Not only does the Scheme seek to draw all profit from the natural catchments, but much will be done to improve the catchments themselves. Over 330 miles of aqueducts will be built to channel relatively unimportant flows into the larger streams.

Indeed, the scientific staff of the Authority is already going further than this and is collaborating with the Australian C.S.I.R.O. (which has been working on ' rainmaking ' for several years) in investigations designed to test the possibility of increasing snow and rainfall in the Snowy Mountains region! Such is the value of water and power to Australia.

Progressive planning and refinement

The Snowy Scheme allows of a certain degree of flexibility in matters of detail. As more and more information is accumulated through survey and mapping, flow gauging and geophysical investigations, it is likely that opportunities for improving on current planning will be found by the Authority. This is already exemplified in a recent proposal to make a quite drastic change affecting a major section of the development.

Thus each successive stage in the construction of the Snowy can be expected to incorporate the best that a large and very skilful staff of engineers and scientists can devise.

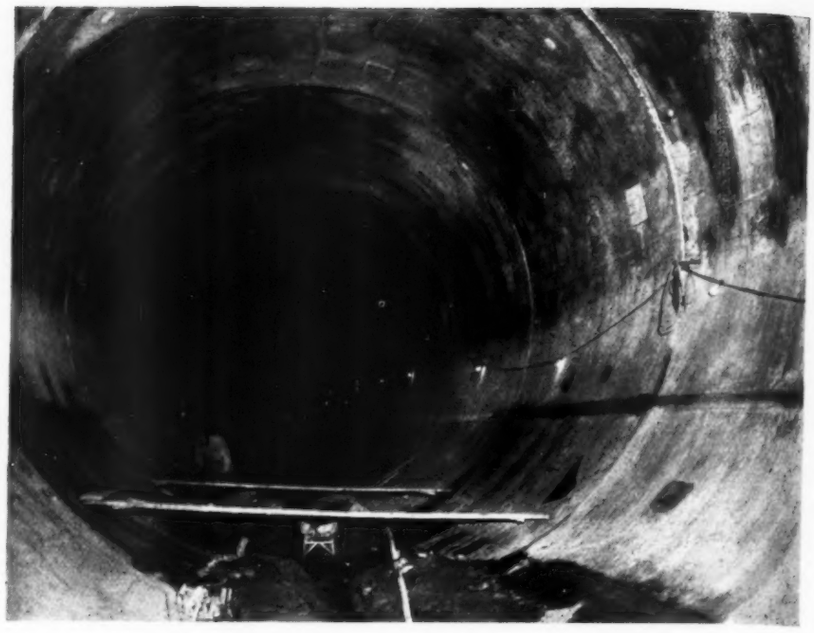
It is perhaps appropriate to mention at this point the part played by the U.S. Bureau of Reclamation, a body with extensive experience in water conservation. The Bureau has co-operated with the Authority since the early stages of detailed planning. With advice and direct assistance, and by training the Authority's engineers in special aspects of the work, it has been of inestimable value to the Authority and to Australia.

Details of the Scheme

The Scheme as it stands is feasible only because it is now possible to undertake enormous tunnelling projects relatively cheaply, and to penetrate

hard rock with amazing speed. It will convey some idea of the rapidity with which tunnels can now be driven to mention that an advance of 402 ft. in six days—a world's record, incidentally—was achieved during May 1955 in the 14-mile Eucumbene–Tumut tunnel.

The Scheme calls for the construction of very extensive underground works, including, all told, 83½ miles of tunnels ranging up to over 30 ft. in diameter, and shafts up to 1,100 ft. in depth; and most of the 17 power stations will be accommodated in rock-hewn caverns. In an uncertain world it is a rather reassuring thought that the greater part of the Snowy system will lie snug in the depths of the mountains.



Workmen hand-finishing the cementing of the 25-ft.-dia. tunnel, which has been driven 2,400 ft. to divert the Eucumbene River during construction of the huge earth- and rock-retaining wall of the Adaminaby Dam

Waters divided

From analysis of the characteristics of several alternative possibilities it was recognised that the greatest advantage would result from diverting part of the Snowy River waters to the Murray and part to the Murrumbidgee. Thus the Scheme embodies two sections, known respectively as the *Snowy Murray Development* and the *Snowy Tumut Development* (the Tumut, it will be remembered, is a tributary of the Murrumbidgee).

Each Development consists essentially of a main storage reservoir and a diversion tunnel to carry the impounded waters from the eastern to the western flank of the Great Dividing Range—a rather complex mountain system in the region where it becomes the Snowy Mountains.

The main storages, the Adaminaby Reservoir (Snowy Tumut Development) and the Jindabyne Reservoir (Snowy Murray Development), will be formed by damming the Eucumbene–Snowy River system at two points.

In this way the waters of the Snowy River will be divided, the flow of the Upper Eucumbene to be held back in the Adaminaby Reservoir being about a third of the present total flow of the Snowy lower down at Jindabyne.

Snowy Tumut Development, the upper dam, the Adaminaby Dam (spillway level, 3,822 ft. above sea level), will be one of the largest rock and earth fill dams of the world, the reservoir (holding 3½ million acre-ft. of water—many times the volume of Sydney Harbour) will submerge the little town of Adaminaby, and the Authority will construct a new township about five miles away from the present site.

The Snowy Tumut Development will take water from the Adaminaby Reservoir through a tunnel under the mountains 14 miles long and 21 ft. in diameter to a balancing reservoir (Tumut Pond) on the western side of the watershed.

Thence, augmented by other waters it will pass *via* two large underground power stations (T1 and T2) at successively lower levels to join with waters brought from the Upper Murrumbidgee *via* a subsidiary series of reservoirs, tunnels and power stations. An alternative proposal has been examined, and recommended, wherein the waters of the Upper Murrumbidgee would instead be diverted into the Adaminaby Reservoir. If adopted, this would mean that two power stations (T3 and T4) would not be needed, but that the capacity factors of T1 and T2 would be improved. Power generated would cost less, but the variation would result in a slight diminution in output, which could, however, be made up if ultimately found desirable by installation of more generators elsewhere.

The combined flow, still with a head of 1,790 ft. above sea level, after traversing two large controlling reservoirs (Cumberland and Blowering Reservoirs), will finally reach the Tumut River at an altitude of about 900 ft. above sea level.

The Snowy Murray Development will accomplish the diversion of the Snowy River, impounded in the Jindabyne Reservoir, through a 30-mile-long tunnel to the Swampy Plains River, a tributary of the Murray. The main diversion tunnel will have a diameter of about 15 ft. at the Jindabyne end, and over 30 ft. at the western end.

Waters arising from subsidiary projects will be dropped into this tunnel at three points—in one case (Island Bend Reservoir) through a shaft 1,100 ft. deep. This is an outstanding feature of the engineering of the Snowy Murray Development. Power stations at the bottom of two of these shafts will extract 285,000 kW. from this ' short-cut ' water.

Some of the water dropping through the Island Bend Shaft will have come from the very highest part of the whole Scheme—from the Kosciusko Reservoir, at an altitude of nearly 6,000 ft. This water will have passed through a series of tunnels, reservoirs and power stations, the whole forming a subsidiary system known as the Upper Snowy Projects.

This is a particularly interesting sector of the Scheme, for it is from one of the Upper Snowy power stations (M1B, or the Guthega Power Station)

that the first fruits of the Scheme have come. It commenced generating in April 1955 and is operating as a 'run of the river' station pending completion of headworks (the Kosciusko Reservoir in particular), which will enable the catchment waters which feed it to be regulated.

Progress made

The Authority faced a formidable task from the outset. The Snowy Mountains region is one of the wildest in Australia, and before operations commenced was traversed by only two roads. Detailed maps were entirely lacking. To assemble the immense amount of data necessary for the prosecution of such a gigantic scheme was itself a daunting task. Not only were detailed surveys needed above ground, but, since the heart of the Scheme would be a complex of tunnels—some of almost unprecedented size—the mountains themselves had to be sounded.

Work was programmed from the start in such a way as to yield tangible results as soon as possible. The Authority decided that the necessary investigations, and the construction of preliminary field works that would obviously be necessary, could well go forward together so that there would be no delay in going ahead with construction as soon as designs were available.

It is worth mentioning that great use has been made of aerial surveys. A total of about 5,500 square miles had to be surveyed and about half this has now been mapped, mostly from aerial photographs.

Roads

Roading the area has entailed great effort and expense. Over 120 miles of heavy-duty roads and more than 150 miles of access tracks have been made. Very large and heavy turbine and generator components will have to be moved up difficult gradients.

The vehicles used forward of the railhead for heavy loads are built on the scale of tank-transporters, but the loads they bear are often much greater. Loads of up to 120 tons are involved and the roads must not fail.

For better efficiency the Headquarters of the Authority has been moved from Sydney to the railhead at Cooma, where accommodation for about 4,000 people has been provided in a new township. The Authority has also set up extensive workshops and stores at Cooma. Other works' townships are also under construction at Jindabyne and Island Bend and at Cabramurra.

The Guthega project

As for work on the development of the Scheme itself, the Guthega (M1B) project on the Upper Snowy River has already been completed and is in operation. Its installed capacity is 60,000 kW. at present, but, when the completion of regulating headworks justify it, a further 30,000-kW. generator will go in. The Guthega project, relatively simple and accessible, was chosen as the starting point of the Scheme. It involved construction of a dam, a tunnel, pipelines and a power station. The dam, 450 ft. long and 110 ft. high, containing 57,700 cu. yd. of concrete, is located at a level of 5,000 ft. above sea level. It forms a small pondage of 1,250 acre-ft. of water.

The tunnel, 19 ft. in diameter and about three miles long, conveys water from the pondage to the pipeline leading to the power station. The rock through which it passes is mainly sound and stable. This tunnel is therefore unlined, except for about half a mile where the rock is doubtful. The pipeline is a little less than a mile in length. It is a single line, 10 ft. in diameter at the top, but bifurcates halfway down, and is 5½ ft. in diameter at the power station.

Present activity

The centre of activity is now the Snowy–Tumut Development. Works in hand include the Adaminaby Dam; the Eucumbene–Tumut diversion tunnel through the Great Dividing Range —14 miles long, it will be remembered; and 21 ft. in diameter—a concrete arch dam on the Upper Tumut River; a 1½-mile-long pressure tunnel to the underground T1 power station; the T1 station itself (320,000 kW.) and a ¾-mile tail-race tunnel.

Work is well under way. As mentioned, world tunnelling records have been broken in the diversion tunnel. All the labour employed is Australian or New Australian, and the work is organised and directed by Americans. Incidentally, this seems to be the point to mention the freedom from industrial disputes which seems to have been a feature of the Authority's operations. Could this stem from some satisfaction felt by all in the knowledge of the great work being accomplished?

T1 power station is expected to be in operation with two generators in 1958, increasing to four generators, its full complement, the following year.

Future programme

Next on the programme is the *Tooma Diversion*, designed to divert the upper waters of the Tooma River into Tumut

In front of the retaining wall of the Guthega pond dam a bulldozer grades the embankment on the precipitous slopes

Pond. This project involved construction of an earth and rock fill dam 225 ft. high and a tunnel nine miles in length and 13 ft. in diameter. The Authority intended to advertise major contracts in May 1956.

Planning work is also in hand for T2, the 280,000-kW. power station downstream of T1. This power station is scheduled to come into operation in 1962.

Further than this point it is difficult to go at present, but by some time in 1963, or a little earlier, the diverted waters of the Snowy and the Tooma, with augmentation from other sources, will be reaching the Murrumbidgee to the tune of 500,000 acre-ft. per annum, more water than is at present being used in the entire Murrumbidgee irrigation area. In due course about 2 million acre-ft. will be added to the present flow of the Murray and the Murrumbidgee.

As mentioned earlier in this paper, this water is expected to enable the irrigated areas to produce upwards of £A25 million more of foodstuffs and other agricultural produce per annum. This water is to cost the States nothing. The entire cost of the Snowy Mountains Scheme will be financed by sale of its output of power!

Conclusion

Frequently it is said that Australia should concern herself less with the development of manufacturing industries and concentrate on her 'natural' role—the production of raw materials, foodstuffs and primary produce generally. Ignoring altogether the implications of such a policy, the simple fact is that Australia's capacity for greatly increasing her output of primary produce over present levels depends, apart from technical advances, upon making very great investments of money and effort on opening up and improving tracts and regions which are at present only potentially productive. Nearly all the 'easy' country is being used already.

Those who understand Australia's characteristics, geography and the pattern of her resources believe that she can, and must, continue to develop and expand both primary and secondary industries.

Snowy Mountains Scheme is a magnificent symbol of the strength of this belief in a dual destiny.

By investment of something short of half a billion pounds of Australian money a great natural resource is being brought into play which will in the end vastly increase production in *all* sectors of industry, thus further strengthening this southern home of the British race.

This paper is an abridged version of that read before the Royal Society of Arts. It was published in its entirety in *J.R. Soc. Arts*, 1956, 104, 887.

Pests in Peanut Fields

A new pest called the *Akrit* has been observed in peanut fields in the southern part of Israel, and is causing considerable concern.

This year it will not have time to cause much damage, since harvesting has begun, but future damage is likely to be considerable unless precautions are taken.

This year a good deal of the picking will be mechanised with the aid of a new machine which will be tractor drawn. Until now picking has been done by hand, since the machinery tended to damage the nuts, and, though this did not matter in the case of a crop grown for oil extraction, it lessened the value of the groundnuts for export as eating nuts. Since Israel nuts were able to command much higher prices abroad as eating nuts, they were therefore picked by hand.

Until now there have been difficulties in finding labour for this task, since the workers dislike the work.

British Equipment in Hong Kong

British-made construction equipment is obtaining an increasing hold on world markets. This International BTD-6 tractor with Drott skid-shovel, owned by Messrs. Sun Hing and Co., of Hong Kong, is being used to clean up a quarry face on the Tai Lam Chung Water Reservoir Scheme. The International-Drott combination is reported to be giving every satisfaction.

In the first few months of British production nearly 200 of these units have been sold to over 20 overseas markets. International Harvester state that the new four-in-one attachment for the Drott has also created world-wide interest and is expected to increase demand considerably. The new unit changes in seconds from shovel, to clamshell, to bullclam and bulldozer, simply by moving a single control lever.

Working with a Drott Skid-shovel, this International BTD-6 tractor is being used to clean a quarry face on the Tai Lam Chung Water Reservoir Scheme

Copra Production by the Smallholder—II

F. C. COOKE

(*Director, Coconut Research Institute of Ceylon*)

A simple and inexpensive kiln for small-scale manufacture of good copra was described in Part I (WORLD CROPS, 1956, **8**, 435). *The details of the preparation and processing of the product are given below.*

IN those countries where the people are wedded to the idea of splitting the coconut fruits with the single blow of an axe it is not easy to persuade them that the more laborious process of first husking and then splitting the nuts is worth the extra trouble or that it will result in better copra.

As this is the key to high-grade copra, it is suggested that skilled workers could be invited from India, Ceylon or Malaya to demonstrate their methods. Thereafter skill could be developed by organising competitions at agricultural shows and gymkhanas.

Collecting the nuts

Coconuts are collected from palms between 20 and 60 ft. in height. They may be cut down by climbers or by men using long bamboo poles fitted with sharp concave knives (Fig. 8). One man can cut 250 palms in a day by using such a pole, but only 25 palms a day if he has to climb.

Coconuts are a seasonal crop in that more nuts are obtained in some months than in others, owing to variations in the climate. Nevertheless, one bunch, whether it be a large or a small one, ripens each month, and the usual practice is to harvest two bunches every two months, *i.e.* six picks per year.

As a result the harvest is a mixture of ripe and less ripe nuts; some ' Kalati ' or very unripe bunches may also be included. To make good copra it is essential to sort the ripe brown nuts, which include fallen nuts, and dry these at once; the remainder should be stacked and kept for one month to harden the meat. ' Kalati ' nuts produce rubbery copra of inferior quality.

Husking and splitting

Husking is done by means of a steel bayonet, mounted on a wooden stake, which is driven into the ground and the fibrous husk is twisted off in four or five segments (Fig. 9). An expert can husk 2,000 nuts in a six-hour day. Splitting is done by striking the nut across the seam with a machete or parang (Fig. 10). This ensures a clean cut with no broken pieces. An expert can split about 9,000 nuts a day, but less skilful people can only work at about one-third of these rates.

Spoilage of raw copra

A relative humidity of over 80% and a temperature below 30° C. provide a condition favourable to the growth of bacteria on the surface of wet coconut meat. If there is more than four hours' delay between splitting open the nuts and applying heat, decomposition rapidly sets in. The first symptom of bacterial attack is seen after six hours as shiny specks of bacterial colonies. Then dull soft patches develop and, after eight hours, the pieces begin to feel gummy; ultimately a slime is produced. Incipient attack by bacteria will cause the resulting copra to be off-white and dirty; once the surface has become gummy or slimy, ' red ' copra will result.

If a heap of husked nuts is left ex-

Fig. 8. This new and quicker method of cutting coconuts permits of some unripe nuts being picked

posed to the sun, the nuts will burst spontaneously and, if these nuts are kept overnight, there will be a great deal of spoiled copra caused by slime development within the cracked nuts. It is essential, therefore, to cover all heaps of husked nuts with sacks or coconut fronds to protect them from the sun or spoilage will be serious.

Sun-drying

Sun-drying as a preliminary to kiln-drying is essential for the production of 'edible white' copra, although high-grade 'estate' copra can be obtained on the smallholder's kiln, without sun-drying, during the rainy season. The advantage of this preliminary sun-drying is that the copra develops a smooth hard surface to which pieces of husk, dirt and smoke do not adhere; furthermore, in eight hours of sun-drying half the contained water is removed (Fig. 11) and fuel is saved. The disadvantage lies in the dependence on the weather, because the copra must be protected if rain threatens, and also because little or no drying occurs when the sky is overcast. Wetting by rain before or after kiln-drying is fatal to quality, as the surface becomes pitted and discoloured and the protective skin is broken.

The split nuts are laid out for sun-drying face upwards on a clean barbecue, made of concrete or of rammed earth or gravel, dressed with 'Colas' or a similar bituminous dressing to prevent contamination of the copra by blown sand or dirt. These half nuts receive about eight hours' drying in the sun before being put into the kiln (Fig. 10).

If two workers husk the nuts the previous day, and split and lay them out for sun-drying the following morning, a fair daily task, covering all incidental operations, will be 1,500 nuts —the standard load for the kiln. (See Fig. 4.)

Fig. 9. Husking nuts one month after picking. A skilled operator can husk 2,500 nuts per day

Correct load

The load which the kiln can take will naturally depend on the size of the nuts. The kiln must not be overloaded or the free movement up through the copra will be impeded and scorched copra will be produced. An overloaded kiln may even catch fire, irrespective of whether the kiln is made of cadjan or of brick, because the upward movement of the rising hot air is impeded.

The correct load is given by the formula:

$$\frac{N}{40} \text{ per sq. ft. of platform}$$

Where N = the number of nuts per candy of 560 lb. (Ceylon)

or $\frac{n}{10}$ per sq. ft.

Where n = the number of nuts per *picul* of 133 lb. (Malaya).

Thus, where the out-turn or conversion rate is 1,000 nuts per candy, or 250 nuts per *picul*, the correct load will be 25 nuts per sq. ft., or 1,500 nuts per kiln. Where the nuts are very small, the load may be increased to 3,000 nuts or more, according to the above formula.

Kiln operation

It is important that the shells used as fuel should be from mature nuts—hard, dry and free from husk. They should be graded for size to prevent interlocking, because if a small shell fills the cavity of a large shell its ignition will be retarded and there will be a period of smouldering and smoking. The fire chains of large shells should be burnt first and the smaller shells can be used when the copra is nearly dry. The fire chains should be loose to allow free ventilation and easy ignition.

In order to avoid excessive production of smoke when the chain is lighted, it is desirable to ignite some broken shells on a shovel outside the kiln and bring them in when they are well alight. Thereafter all the kiln doors should be kept closed to prevent disturbance of the fires, the progress of which can be seen by looking through an observation window set in the kajang walls.

TABLE 3

Grades of Copra

'Edible white' or dried coconut . .	Smooth, hard, crisp, white, round cups, entirely free from smoke, colour or moulds. (In some places there will be a preference for small cups.)
No. 1 copra . .	Smooth, hard, crisp and uniformly white to greyish-white pieces.
No. 2 copra . .	(*a*) Distorted copra from under-ripe nuts. (*b*) Thin and broken copra from over-ripe nuts. (*c*) Off-coloured pieces—either scorched or chilled 'red' pieces.
No. 3 copra . .	(*a*) Distorted, thin corrugated copra from very unripe (Kalati) or immature nuts. (*b*) Discoloured or ragged copra from bad nuts.

It has been found that 1,500 large nuts, which have been previously sun-dried, can be dried with eight fires, each of four hours' duration, allowing two hours between fires for the ashes to cool. If this is not done, the next charge of shells may all be ignited by the concealed glowing embers of the previous fire. In wet weather, when sun-drying is not possible, 12 fires will be required.

Fuel consumption with sun-drying, 60% of the available shells.
Without sun-drying, 90% of the available shells.

Even whiter copra, *i.e.* 'edible white' grade, can be obtained by burning a 1-in. layer of well-burnt charcoal in the hearth. A bed of charcoal, 12 ft. long, takes 15 hours to burn if lighted at one end. This makes for simpler operation, but the supply of charcoal will soon run out, as the fuel consumption is equivalent to 160% of the supply of shells. This means that charcoal has to be bought.

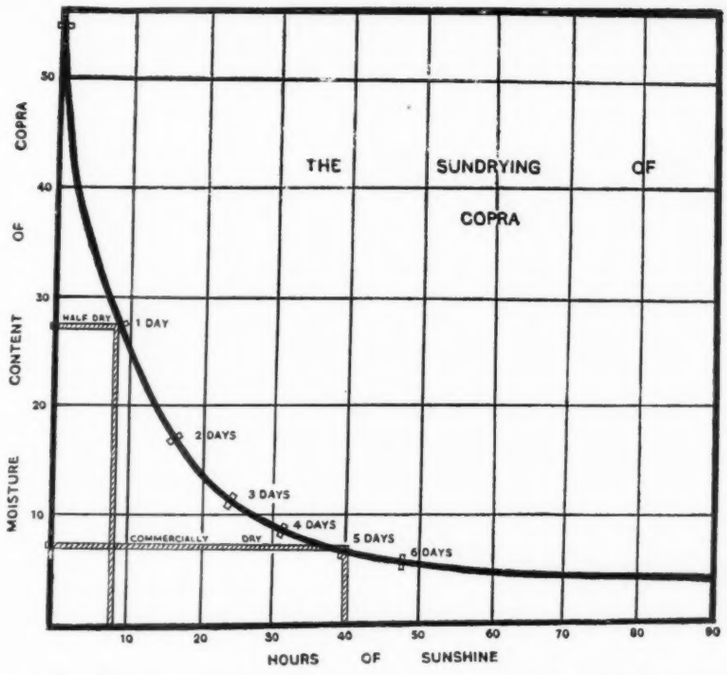


Fig. 11. Graphic representation illustrating the rate of drying of copra in continuous sunshine

Marketing

It is not only essential that the product should be crisp and dry, but it should also be graded before sale or it may still only be valued as 'mixed' copra and bought at a discount. However carefully the copra may be produced, there will always be a small percentage of off-quality pieces which should be picked out and sold separately. The product from the kiln should, therefore, be sorted into two or more of the grades shown in Table 3, according to market requirements.

There is at present only a very limited market for edible white copra for direct consumption as food in the form of grated coconut, sweets, biscuits and cakes, or for use in temple lamps for ceremonial purposes. There is room for a considerable increase in the direct consumption of dried white coconut as food in countries where the people are under-nourished and there are no coconut palms.

The small film of smoke on ordinary commercial copra acts as a preservative and, providing it is hard and dry, it may be stored for as long as a year without anything worse than a superficial development of green or buff moulds. Edible white copra will not retain its pristine appearance for more than three months, although if the last fire is sprinkled with flowers of sulphur and the product is again laid out in the sun after kiln-drying its storageability will be extended.

Fig. 10. Sun-drying nuts after splitting. An expert can split more than 9,000 nuts per day

Summary and conclusions

The construction and operation of a simple and inexpensive kiln for the production of high-grade copra has been described.

This series is principally of interest to the smallholder who cannot afford or has not sufficient crop to justify the heavy capital expenditure entailed in the purchase of a hot-air drier. For

(Continued on page 493)

The New Ferguson Tractor

For the first time in 10 years Massey-Harris-Ferguson have announced the introduction of a new Ferguson tractor —the Ferguson 35. This tractor, claimed to be the most advanced all-purpose tractor yet built, is available immediately. It is manufactured by the Standard Motor Co. at their Banner Lane factory in Coventry, where since 1946 over 520,000 Ferguson tractors have been produced. This factory, which has been completely retooled at a cost of over £4¼ million, has now an output capacity of 100,000 tractors per annum.

The Ferguson 35 incorporates numerous entirely new features resulting from intense research undertaken, over the last 13 years, to establish the future demands of operating conditions throughout the world.

The well-known assets of the Ferguson system of integrated tractor–implement design have been considerably enhanced and expanded by the introduction of the Ferguson 35.

Position and response control

In this new tractor the Ferguson hydraulic system has been revolutionised. In addition to the former draft control and the ability to lift and lower the implement, the new and improved hydraulic system now offers the extra benefits of position control and response control of implements, thus increasing overall efficiency.

The Ferguson 35 has six forward and two reverse gears providing speeds varying from 0.3 m.p.h. at 500 r.p.m. engine speed up to 14 m.p.h. at 2,000 r.p.m. This is made possible by the provision of an epicyclic reduction gear unit. There are also two different p.t.-o. drives: engine speed p.t.-o. for such jobs as mowing, baling, combining etc. or ground speed p.t.-o. for haymaking, planting, fertilising etc. There is also a de luxe model, which is fitted with a live p.t.-o. and dual clutch.

Increased engine power

The engine power of the new tractor has been substantially increased in the case of both the diesel and the petrol versions to 37 b.h.p. The horse-power of the V.O. and lamp oil engines has been increased proportionately.

Among the many other important new features are included a new standard of steering efficiency through a recirculating ball-type mechanism, a new back axle design, two in-line brake pedals located on the right-hand side of the transmission, three implement mounting pads (for front-, mid- and rear-mounted implements), a new safety starter etc. Also new are the safety fuel tank, the instrument panel, the removable grille and the styling, the latter in two-tone Ferguson grey and metallic bronze. The de luxe model has a foamed cushion seat and padded back rest.

Hydraulic system

The hydraulic system has been developed considerably and the following increases have been made: pump capacity 20%, pressure 25% and lift effort of lower links 25%. The overload release now operates at 2,000 lb. above the predetermined draught, instead of at 3,400 lb. including draught. A new double-acting spring ensures automatic depth control when the top link is in compression or tension.

There are two hydraulic control levers. One can be used to raise and lower an implement or stop it in any predetermined position, or vary the speed of its reaction to different soil conditions. The other controls draught and depth and the use of external hydraulic rams.

The new features of the hydraulic system increases its sensitivity and flexibility, particularly for hoes, drills, thinners, and also where the soil varies in texture and surface.

Cultivations with the new Ferguson 35 can be carried out faster and more economically. The increased horse-power, improved hydraulic system and six forward and two reverse speeds enable the farmer to make the best use of favourable weather conditions

Steering and axles

The steering is new and the rear axles and final drives have been strengthened. In addition to being attached to the three-point linkage, implements can also be mounted on special pads under the front, middle and rear of the chassis.

Considerable attention has been paid to minor details. Channels are fitted to the sides of the fuel tank to drain spilled fuel away from the hot engine. A hinged flap in the bonnet allows access to the fuel tank and battery while the bonnet remains down.

Two most important considerations have been provided for in advance. The first is that, because the components of the Ferguson 35 are all different from those of the preceding model, a large stock of new spare parts has already been built up and is immediately available. The second is that all Ferguson implements designed

for the previous model will fit the new tractor, though a few will require minor modifications. The Ferguson 35, with its increased horse-power and greater sensitivity, should enable farmers materially to increase their output per man and per acre.

The new Ferguson was demonstrated in operation during the World Ploughing Championship at Shillingford, England, on 10–12 October.

Front-mounted loader

An attempt to take the toil out of manual work on the farm has been made by the introduction of the new Ferguson FE35 loader, which is now in production. It is the first new implement to be specially designed for the new Ferguson tractor and will have the widest possible use on every farm.

Loads up to 2,000 lb. (approximately 17¾ cwt.) can be lifted to a height of 9 ft. 11 in. at the tine tips. The design of the loader and fork enables efficient and easily controlled operation in feeding yards and other confined spaces.

In connection with the Ferguson tractor, trailer or manure spreader with automatic hitch, the new FE35 loader brings a mobile form of power loading for all types of material.

Tubular construction design gives maximum strength with minimum weight to this new loader, which has been designed primarily for general handling of soil and manure on the farm. It is compact and manœuvrable and the modern frame design allows the operator to mount the tractor easily from either side.

This loader will be an essential part of a unit that enables one man to load, transport and spread manure without leaving the tractor seat.

The manure fork is balanced so that it will return automatically to the loading position after dumping. Dumping is effected by releasing a spring-loaded latch operated from the driving position by means of a lever and wire connection.

A push-off fork similar to that used on the high-lift loader is being designed for use with the new implement. Trip and hydraulically operated buckets will also be available at a later date.

A front-end loader not only saves labour, but represents a big step towards the mechanisation of livestock husbandry. Because this provides regular non-seasonal use for a tractor, it increases the number of hours of profitable occupation for that tractor. Depreciation, which is a major factor in tractor costs, is thus spread over a greater number of hours, reducing the total cost per hour for operating the tractor.

In the case of a tractor working 700 or 1,000 hours per year, the reduction per hour, achieved by increased use, may be as much as 9*d*. an hour.

Copra Production—II

(*Continued from page* 491)

larger properties and plantations, and where labour costs are high, patent hot-air driers offer many advantages.

Acknowledgments

I gratefully acknowledge the help received from the following officers of the Coconut Research Institute of Ceylon: Mr. D. F. Withana, estate superintendent; Mr. V. Abeywardene, biometrician; and Mr. D. B. Hettiarachchi, photographer.

S. Rhodesia Forest Reserves

A recommendation that at least 7 million acres of land in Southern Rhodesia should be reserved as soon as possible for forestry is made by Prof. H. G. Champion, of the Imperial Forestry Institute, Oxford, in a report submitted to the Southern Rhodesia Government. Prof. Champion says that some of this huge area should be suitable for pine plantations, though the greater part must be in the indigenous hardwood forests.

It is recommended that the total area of softwood plantations should be increased to about 300,000 acres, of which at least a third should be planted by the State, to meet the softwood needs by the end of the century of a population of one million Europeans and six million Africans. The report says that the present permanent allocation of land for forestry has made good progress, but it is considered still inadequate both in area and distribution. The ideal would be one acre of productive forest for each head of population.

Pakistan Tea

The Pakistan Tea Board, which recently met in Dacca, envisages in its report an increase in the existing average annual production of tea of 54 million lb. to 75 million lb. in the next 10 years. The Board felt that the tea industry in Pakistan required, among other things, Rs. 5 millions' worth of fertilisers, fungicides and insecticides and about Rs. 7,500,000 worth of capital equipment to improve and maintain manufacturing capacity.

Caterpillar Re-grouping

As from 1 January, 1957, the overseas operations of the Caterpillar Tractor Co., of Peoria, Illinois, will be regrouped to form a combined Foreign Trade Group. This group will encompass the three existing subsidiaries:

Caterpillar Tractor Co. Ltd. (England)
Caterpillar Brazil S.A. and
Caterpillar of Australia Pty. Ltd.

thus bringing together into one closely co-ordinated organisation all activities concerned with sales outside the U.S.A.

N.I.A.E.

Mr. Alan Lennox - Boyd, M.P., Secretary of State for the Colonies, paid an informal visit to the National Institute of Agricultural Engineering (Great Britain) recently in order to see special lines of work being undertaken by the Institute in relation to overseas agricultural conditions. The Institute is conducting several projects in co-operation with the Colonial Office and with agricultural research workers in the overseas territories.

Particular interest was taken in the work of the Soil Department, which includes the development of special machinery for carrying out cultivations under the difficult conditions of the semi-arid tropics. Another important aspect of the Institute's work is represented by the new East African unit which is about to be established with its headquarters in Kenya. This unit will devote much of its time to the testing of commercial machines on farms in East Africa. Recent additions to the research facilities at Silsoe include the construction of a dust chamber and a tropical room, in which tractors and engines can be submitted to rigorous tests.

A Trappist monk belonging to La Grande Trappe Abbey in Normandy, France, uses a McCormick International tractor to propel the modern harvester-thresher of the same make. The Trappists farm a large acreage of wheat and oats and use the combine for their harvesting needs

French Trappists are Modern Farmers

MODERN farming practices go hand in hand with an ancient and strict way of life at La Grande Trappe Abbey in Normandy, France.

The monks of the Saint Benoit Order of the Trappists are experienced farmers, cultivating 575 acres planted to cereal grains and pasture, a herd of 80 cows and flocks of domestic fowl. The farm produce is principally for the monastery's use, with surplus wheat being sold in outside markets.

Up until 1895 the Trappists practised hand reaping. During that year they purchased a McCormick reaper and in 1902 a McCormick binder. In 1925 the abbey put a Farmall tractor to work in their fields, and added another in 1930.

For the 1954 harvest the abbot decided to purchase a modern McCormick International harvester–thresher and tractor, both manufactured in France.

The abbot explained that before the new harvester–thresher was used the harvest required a considerable period of time. Normandy is a rainy region and the sheaves of grain often became wet in the field and had to be opened and dried in the sun. In the winter, the abbot said, threshing required more than a month. Now, with the new combine, the labour problem at the monastery has been greatly eased.

La Trappe was a Cistercian abbey founded in 1140 near Soligny, Normandy. The name derives from game trapping carried on in that area. A series of wars laid waste to the area in the following centuries and Abbot Armand Jean de Rance rebuilt the ruins in 1662. The French Revolution dispersed the religious community at La Trappe, the monks settling in Switzerland. In 1817 they returned to La Trappe, rebuilding the ruins again and eventually becoming a separate Order. Several of the present buildings at La Trappe date from 1895.

While the Trappists were in Switzerland they began establishing monasteries in other parts of Europe, and later in other parts of the world.

Every Trappist monk is required to perform tasks according to his strength and capacity and all share the same basic poverty. Discipline is extremely austere and there is much study, prolonged fasting and manual labour. The Trappists eat a restricted diet and live in a world of perpetual silence among themselves. With outsiders they use only a minimum of words.

Malayan Forests

The Conservator of Forests in Kuching has stated that by 1960 large tracts will be held as forest reserves which will protect the headwaters of many important rivers and constitute a valuable source of timber supply. The Colonial Development and Welfare Fund have granted the Forestry Department £363,000 to continue mapping the forest reserves of the country. This amount will provide an estimated 75% of the money required between 1956 and 1959. It is hoped that at least 25% of the total area in Sarawak can be kept as permanent forest.

Pastures in Northern Nigeria

A start has been made on the scheme for extending the grazing reserve at Diwanau, in Northern Nigeria. The object of this scheme is to grow selected grass on farmland which for many years has deteriorated owing to over-grazing and consequent sheet erosion. By deep ploughing, sowing good grass seed and adding superphosphate, considerable progress is being made in improving this land. The initial 160 acres treated in this way have been increased to 400 acres.

A dam providing water throughout the year has been built, thus ensuring good grazing land in the dry season. Local people have been very co-operative in this enterprise, which, it is hoped, will result in a stable cattle population in the region.

Fison's Research Station

About 130 people were present when Chesterford Park Research Station, an adjunct of Fisons Pest Control Ltd., was officially opened by Sir William Slater, K.B.E., D.SC., F.R.I.C., Secretary of the British Agricultural Research Council. The majority of those present were scientific workers interested in pest control and they included representatives from many other research stations, the British Ministry of Agriculture, the Colonial Office, the Empire Cotton Growing Corporation and the Imperial Institute.

The new station consists of 220 acres and the primary object is to provide facilities for demonstrations and experimental work with both crops and stock.

NEW PUBLICATIONS

The Hardiness of Plants

By J. Levitt. 'Agronomy: a series of Monographs', Vol. 6. Pp. 278. New York: Academic Press Inc.; London: Academic Books Ltd. 1956. $7.00.

Those of us who are exposed to the climate of the British Isles tend to think of hardiness in plants as the ability to survive the alternations of frost and thaw which make up our winter and the bitter winds and late frosts to be expected in spring. Hardiness, as described by the author of this book, is a much more sharply defined property. He applies it in a wider sense to other unfavourable conditions besides cold, such as extreme heat and drought. But, in another respect, he narrows his definition by distinguishing between 'environmental resistance', features of the plant protecting it from an adverse condition, such as drought or cold, and 'hardiness', the power of the plant to survive although dried up or chilled. The author is primarily concerned with physiology, with the reaction of the plant cells exposed to adversity.

This book is a review of the published work on the subject, to which the author adds his comments and appraisal. Dr. Levitt hails from Missouri and in his introduction he mentions that the compilation was made during a sabbatical year spent in Europe. The titles of papers to which reference is made occupy 44 pages of close print, number nearly 1,000, and are pleasingly international in origin. There are 28 chapters in the book, of which rather more than half relate to hardiness to cold and ice and the rest to drought and to heat. The chapters, though short, are packed with substance and the author writes concisely and without wasting a word, frequently using a table or a graph to drive home a point.

This is volume 6 of a series of monographs prepared under the auspices of the American Society of Agronomy, and it should prove a useful companion to all engaged in the study of physiology and of the response of the plant to its environment. A recent tribute to the scientific writer, the late Prof. A. M. Low, recounted that, when asked what was in his opinion the greatest scientific discovery, he would reply, 'The greatest discovery is that we know practically nothing about anything'. Not the least of what Dr. Levitt does for his readers is to help them to discover, despite all the work which has been done and to which he refers, how small is yet our real understanding of what goes on in the cells of the plant.

T. A. RUSSELL

Common Cultivated Crops of South India

By V. T. Subbiah Mudaliar. Pp. 606. Madras: Amudha Nilayam Private Ltd. 1956. Rs. 15.

In this book Mr. Mudaliar attempts a comprehensive account of agriculture in South India—to be more exact, in the States of Madras and Andhra—in conformity with the syllabus prescribed for degree courses in agriculture by the universities of South India. To achieve his object he gives information on meteorological, soil and other factors governing farming in this region and then deals with the principles of manuring, tillage, irrigation and classification of crops. A great deal of this information is of a very elementary character and is quite out of keeping with the subject of this book. The space devoted to these sections might have been used with advantage for more scientific information on South India soils, customary and modern tillage methods and a more precise and detailed account of irrigation systems developed in India.

The main part of the book is devoted to chapters on cereals, pulses, oilseed crops, miscellaneous food crops, sugars, condiments and spices, fibre crops, narcotics and green manure crops. A final chapter is concerned with pastures and forage crops. The numerous illustrations are generally well chosen, adequately reproduced and greatly assist the text.

One is impressed by the vast amount of valuable information presented on the cultivation of crops in South India, assiduously collected during the author's 30 years' service in Madras and Andhra States. The section which records these observations should be of inestimable value to students of agriculture. Some important methods and innovations adopted in other countries are incorporated in his account and attention is drawn to many results of research work in India and elsewhere which are likely to affect the future of Indian agriculture, but there are many notable omissions and greater prominence might have been given to the results of Indian research.

Two further criticisms must be mentioned: the absence of an index and the inadequacy of the bibliography, both bibliography and index being essential in a book of this nature. The author appreciates the inadequacy of the present bibliography, which contains only 25 references, some of which are out of date. It is to be hoped these shortcomings will be corrected in future editions, for there is so much worth-while information in the book that it should prove acceptable to the readers for whom it is primarily intended.

D. H. GRIST

American Tomato Yearbook

The 1956 edition of this yearbook has now been published. As usual, it contains much information concerning tomato culture and the manufacture of tomato products. Price $2.00.

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Tobacco Research

The Tobacco Research Board of Rhodesia and Nyasaland have published a Report of Progress for 1953–55. This report summarises and discusses briefly the advances made in research since the earlier report 1951–53 was published. It is to be noted that tobacco breeding, disease and nematode control, and chemical investigations are now centred at Kutsaga, where laboratories were opened in 1954. Agricultural engineering research is also being developed there. In addition to the seedbed and field-plot work with flue-cured tobacco at Trelawney, insect control studies and a compact, but comprehensive, set of experiments on Turkish tobacco is under way at that station.

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OEEC Publications

The Written Word in Agricultural Advisory Work. Agricultural advisers everywhere are experiencing more and more difficulty in meeting the ever-

growing demand for advice. With the impossibility of significantly adding to available numbers of qualified personnel, workers are anxious to complement individual contacts with advisory methods which reach greater numbers of farmers for a given expenditure of effort.

This handbook, ' The Written Word in Agricultural Advisory Work ', which is a pooling of the best available knowledge from 18 European countries and America, shows how the farm visit can be effectively co-ordinated with the use of mass methods (the press, leaflets, circular letters, radio etc.) and how these activities complement one another.

The manual further deals with basic theory and practice of communicating information, planning and co-ordinating advisory programmes, principles and practice of good writing, readability and illustration, evaluation of advisory activities and the preparation of scripts for radio and television.

The book will be found invaluable by all who are concerned with communicating information or ideas to the rural community, whether they be general advisers, agricultural or livestock specialists, home economists, rural youth leaders, information workers, staff or students at colleges, or employees of farmers' organisations and of commercial firms dealing with agriculture. Price $1.50. 9*s.* 0*d.* 450 F.fr.

Agricultural Policies in Europe and North America. This report is based on a systematic examination of participating countries' agricultural policies held under the auspices of the Committee of the Ministers of Agriculture of the Organisation. The report was compiled by a committee on which all member countries, Spain, Yugoslavia, the U.S.A. and Canada were represented. The Ministerial Committee approved this report in May 1956 and decided on its publication. Price 18*s.* 0*d.* $3.00. 900 F.fr.

OEEC at Work for Europe. Appropriately, OEEC has just published a new edition of the booklet—' OEEC at Work for Europe '—which gives an account of the Organisation's many activities in the form of short studies by members of the Secretariat dealing with their particular spheres of work.

Control of Johne's Disease in Cattle, Sheep and Goats. This report describes one of a series of activities sponsored by the European Productivity Agency of the Organisation for European Economic Co-operation, with the object of increasing the efficiency of European agriculture and reducing the production costs of livestock products to the mutual benefit of producers and consumers. Among the more important factors in this connection is the adoption of control measures for livestock diseases. Adequate control measures would lead to greater profits to producers of livestock, owing to lower mortality in animals and to large economies in feeding-stuffs. This in turn would lead to higher quality and cheaper supplies.

The present publication includes the basic report prepared on behalf of the European Productivity Agency by the Central Veterinary Laboratory of the Ministry of Agriculture, Fisheries and Food of the U.K., the papers presented by the guest speakers and summaries of the discussions.

*

Empire Cotton Growing Corporation

We have received copies of the progress reports from experiment stations (West Indies, Tanganyika Territory, Lake Province, and Tanganyika Territory, Eastern Province) for the season 1954–55, together with a survey of all the reports for the same period.

*

SPC Publications

The South Pacific Commission have recently published *Technical Papers Nos.* 89 *and* 90. The first, entitled ' Small-Scale Industry for the South Pacific ', by Cyril S. Belshaw, is intended as a preliminary survey of a number of matters that bear upon research designed to assist programmes of small-scale industrialisation in the Pacific islands. Price 4*s.* 0*d.*

The second paper, entitled ' Industrial Activity in Selected Areas of the South Pacific ', by K. H. Danks, reports on current industrial activities in five South Pacific territories and is of great value in describing the industries that have developed, the conditions under which they operate and the difficulties which they have to face. It should be found useful by all potential investors in industry in the island territories. Price 5*s.* 0*d.*

Pesticide Handbook

A completely revised eighth edition of Pesticide Handbook, by D. E. H. Frear, published by College Science Publishers, State College, Pennsylvania, U.S.A., provides a list of 6,111 products under the headings Insecticides, Fungicides, Herbicides, Rodenticides, Soil Conditioners and Equipment. Other useful information for persons interested in pest control includes a section entitled ' New Tolerances '. Price, paper-bound $1.25, cloth-bound $3.00.

*

Tea Manufacture in Ceylon

Another of the Monographs of Tea Production in Ceylon has been published. This Monograph, No. 4, concerns tea manufacture in Ceylon and was prepared by E. L. Keegel. It is a record of the knowledge acquired from experimental and advisory work carried out on tea manufacture during the past 24 years.

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Alabama Polytechnic Institute

The Agricultural Experimental Station of the Alabama Polytechnic Institute have now published the 64th and 65th Annual Reports for January 1953 to December 1954. It comprises a summary of research and practical work undertaken by the station and of particular interest are the main headings: Agricultural Economics, Agricultural Engineering, Agronomy and Soils, and Forestry.

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Grain Storage

The Colonial Office is to continue its encouragement of attempts to store colonial grain crops in underground pits. This is announced in a pamphlet published by H.M.S.O. (2*s.* 6*d.*), which describes experiments which have been carried out in the last few years in East and West Africa.

So far pits holding up to 1,000 tons of maize have been built. In all cases the moisture content has been less than 13%, but the pamphlet suggests that even wetter grain may be successfully stored in this way and that crops like groundnuts would also benefit. Storage for 10,000 tons of barley is to be completed in Cyprus this year, and Tanganyika is to be provided with 11,000 tons of pit storage.

MACHINERY AND EQUIPMENT

Moto-matchette

The ' Moto - Matchette ' P.P.K., manufactured by Etablissements P.P.K., France, is composed of a motor and transmitting axle in a metal tube, at the end of which any one of a number of pieces of equipment may be attached.

The motor drives the axle through an automatic gear device. As the arm is 1.3 m. long, the equipment in use is operated at a safe distance and, moreover, the length of the driving arm permits access to narrow and difficult places without danger. The apparatus is carried on a harness, so allowing the operator to devote his full attention to the work. The ' Moto-Matchette ' is easily adjusted with respect to the operator and his work. The only hand lever is situated on the shaft and controls the speed of operation of the working head.

The various attachments can be interchanged quickly and easily; they include a circular saw, pruning saw, lopping attachment, auger and a hoeing device.

National NA-75

A new ' composite ' aircraft designed to meet the unique and exacting demands of ' ground level ' flying of the agricultural aviation industry has just been designed and put into production by National Aircraft Corporation of Burbank, California. Specifications for the plane, the National NA-75, represent the joint research of N.A.C. engineers, pilots and operators.

Features of the plane are the National ' Hi-Lift ' wings of biplane configuration, which will permit the handling of pay loads up to 2,000 lb. with stalling speeds as low as 35 m.p.h.; special metal fuselage panels which can be removed from firewall to tail in five minutes with only a screwdriver; and modern design dispersal equipment that minimises drag and permits instant changeover from dust to spray or spray to dust.

The ' Gottingen 398 ' wings are fabric covered over all-metal structure, engineered to permit assembly or repair with a screwdriver and ordinary wrenches for fast, easy repair in the field. Sewing or rib stitching of fabric is eliminated by the use of fabric clips. The centre section is all-metal skin-stressed construction. Combined wing area of the upper and lower wings is 338.26 sq. ft.

National ' Hi-Lift ' wings have been in use for more than two years by operators throughout the U.S.A., Mexico, Cuba, Hawaii and Canada and have flown more than 90,000 hours without a failure.

The fuselage has been covered with 10 metal fuselage panels, secured by ' Airloc ' fasteners. Two men, using only screwdrivers, can strip the fuselage from firewall to tail in five minutes for inspection, maintenance, or for the removal of corrosive chemicals from the primary structure. For safety and better visibility, all instruments have been removed from the cockpit and

Reader Service

For further information on any item of machinery or equipment reviewed in this section please write to:

Reader Service,
WORLD CROPS,
Stratford House,
Eden Street, London N.W.1,
England

The ' Moto-Matchette ' is a readily adaptable implement that can be used to advantage on farms, orchards and vineyards

The NA-75 is a duster-sprayer biplane featuring a radically improved Stearman fuselage. It includes all-metal structure National ' Hi-Lift ' wings and dispersal equipment designed to reduce drag and which provides instant-change spray to dust rigging

installed in the trailing edge of the centre wing section. The cockpit is covered with a 6-in. crash pad and chrome-moly wire cutters are installed on landing gear, wing struts and vertical fin. The plane is designed to fly in a nose-low attitude at all times for better visibility.

Emergency dump

A combination 31.7 cu. ft. reinforced fibre-glass, dust-spray hopper permits instant change from spray to dust or *vice versa*. A liquid-tight dust gate acts as an emergency dump valve, which can completely dispose of a load in five seconds. To eliminate drag the pump, agitator drive, shut-off valve and all plumbing to the spray boom is located inside the fuselage. The spray pump and dust agitator drive are engine-driven through variable-speed p.t.-o., which is controlled in flight. The dusting venturi is a low-drag airfoil type and the spray boom is mounted on the trailing edge of the lower wing.

The NA-75 can be powered by the Continental 220, Lycoming 225 or 300, Jacobs 245 to 300, Pratt and Whitney 450 or Wright 425.

As an indication of its performance, the NA-75 equipped with a 220-h.p. engine can take off in 890 ft. with a pay load of 1,250 lb. A 450-h.p. engine can take off in 785 ft. with a 2,000-lb. pay load.

'Any Angle' Mower

It takes five minutes only to attach the front-mounted 'Any Angle' mower with quick coupling pins to four brackets on the tractor.

The brackets, which are supplied, bolt semi-permanently: (*a*) at the front, either on the engine frame, or on the front axle, to carry the main frame of the machine; (*b*) at the rear on the hydraulic lift to control height; (*c*) just in front of the driver to carry the winch for angling control.

The machine offers one-man operation with normal tractor controls for steering and manoeuvring on irregular verges, with height control of main beam unit through tractor hydraulics to clear kerb on raised verges and to reach up banks. Angle control of cutter bar is by a small hand winch mounted near the tractor driver's left hand. Mower knife speed is *via* a variable governor control on the engine operated by the driver.

Cutter bar

The cutter bar units are built with special countersunk bolts and nuts to give a smooth finish to prevent clogging, a reciprocating ' wiper ' is fitted to remove accumulation of cut matter. Knives are specially strengthened to cut strong growth and small scrub. Cutter bars of different lengths are offered, those of the standard agricultural type (5 ft. and 2 ft. 6 in. long) having a specially designed inner shoe to ride over accumulations of cut growth, the placing of a swath by a swath board not always being possible when mowing slopes. The special bank bars (5 ft. and 3 ft. 3 in. long) are designed to cut throughout their whole length and are intended primarily for areas where the verge springs straight from the road surface.

As a safety precaution spring-loaded breakaway devices in two planes are fitted to allow the cutter bar to swing away and disconnect drive on hitting a hidden obstacle. Drive is by a triple-'A' V-belt on Fenner taper lock pulleys and either a Petter-type A1 petrol engine or a Petter PAZ air-cooled diesel engine is offered.

In the ' Any Angle ' mower the cutter-bar units are built with special countersunk bolts and nuts to give a smooth finish to prevent clogging; a reciprocating ' wiper ' is fitted to remove accumulated cut matter

Mounted Combine

A recent development in the history of farm mechanisation is the announcement of the new Ferguson mounted combine. With the introduction of this machine the Ferguson system is extended to include harvesting. Mounted on the tractor and quickly detachable, it enables the farmer to reduce to an absolute minimum both depreciation and idle capital in the winter months when the combine is not in use. Standardisation on Ferguson equipment is now made possible for the complete farming year.

With a cutting width of 7 ft. 6 in., this machine offers farmers with limited acreages the useful features and advantages of a self-propelled combine. Mounting the combine on the tractor provides a unit which is exceptionally stable and which can negotiate steep hills with ease and safety.

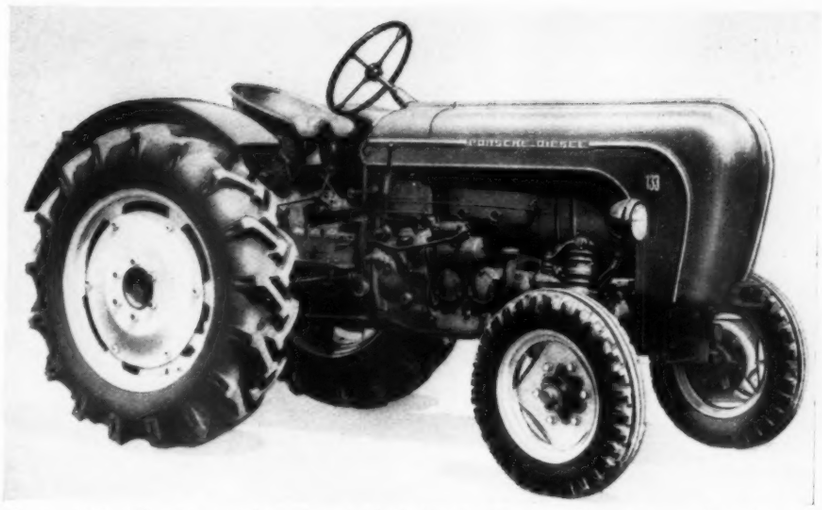
The manufacturers claim that the machine will harvest any crop—from grass seed to beans.

Among the many interesting features of this new combine are a range of height of cut—hydraulically controlled—from 2 to 32 in.; reel position controlled from the operator's seat by hydraulics; pre-packed sealed, plastic and oil-retaining bearings; drives shielded by quickly detachable guards; cutter-bar cutting 5 in. below the horizontal to get into hollows.

Three models will be manufactured: a two-spout bagger, a three-spout, rotary screen bagger, and a grain-tank model for bulk handling. The combine can be mounted on Ferguson tractors with diesel, petrol or V.O. engines.

Porsche-Diesel A 133

It is claimed that the A133 is the ideal tractor for the large and medium-sized farms. With additional weights before the front axle and on the wheels the weight of the tractor can be easily adapted to the particular type of work to be done. The A133 is equipped with a hydraulic fluid clutch (Voith), permitting smooth starting with any gear engaged, thus ensuring maximum saving of engine, transmission and chassis, even when the tractor is overloaded or improperly handled.



Some outstanding features have been included in the Porsche-Diesel A133. Attachments include a tyre inflator, a lightweight hood and an enclosed driver's cab

Three p.t.-o.s

Unobstructed view all round and on work being done. All parts and controls are accessibly located. Simple maintenance. Spring - suspended, swinging-type front axle. Two p.t.-o.s at the rear, one turning synchronously with gear engaged and one at rated speed. One further p.t.-o. at front, turning at 925 r.p.m., by which implements mounted in front of the tractor can be operated.

Six gears

There are five forward and one reverse sliding gears, a differential lock and three brakes (hand, foot and a steering brake). Lubrication is force-fed by means of gear pump, oil passing through main stream and secondary stream filter. The A133 also has front- and rear-mounting attachments with power transmission to a mower direct from engine, 1,000 r.p.m. A broad type drawbar for all trailed machines, a hydraulic power lift with automatic compensation for tractor rocking and adjustment for uniform working depth.

Beet Seeder and Thinner

This implement can be used for sowing as well as thinning sugar-beet. It has been designed by the Sugar Beet Mechanisation Institute of the Swedish Sugar Co.

Seed drill

Design.—The ' Hilleshög ' seed drill has been designed for attachment to the hydraulic lift on the tractor. The drilling mechanism is driven by the tractor p.t.-o.

The coulter has been designed to provide the best germinating conditions for the seed. Wings are fitted on both sides of the coulter to push aside any dry clods in the soil, so that they do not fall into the seed row and prevent seed germination.

The feed mechanism consists of a rubber feed band which moves backwards and forwards. The feed band is perforated with holes which are large enough to allow one seed to pass through at a time, so that the seeds are planted singly when drilling. A roller follows the coulter and presses down the seed into the moist soil. Two mould irons are fitted immediately behind the roller and cover the row with soft soil from both sides.

The Overum-Hilleshög combined beet-seed drill and beet thinner fitted for sowing. Made for hydraulic lift and is p.t.-o. driven

Thinner

The implement can be converted from a seed drill to a thinner in the following way:

(1) Replace the large gear (52 teeth) with the smaller (13 teeth).

(2) Shorten the chain and fit on the setting roller.

(3) Replace the drilling equipment with the thinning blades.

(4) Fit the support wheels.

(5) Fit the steering device.

(6) Remove the markers.

Thinning blades.—Three sets of thinning blades are supplied with the implement. These blades are marked from 1–3. 1 = 30 mm., 2 = 35 mm. and 3 = 40 mm. The type of thinning blade used depends on the state of the plants.

Water Buffalo

The Albion Cuthbertson ' Water Buffalo ' tractor has been described as ' one of the most interesting developments in tracklayer history with a hill and bog performance which must be seen to be believed '.

This machine is designed for use on soft land, where low ground pressure is essential, and at the same time the machine must have a high drawbar pull when used with drainage ploughs and other similar equipment.

The Albion engine and driving machinery of the tractor is enclosed in a water-tight steel hull, allowing it to be used in free water up to a depth of 4 ft.

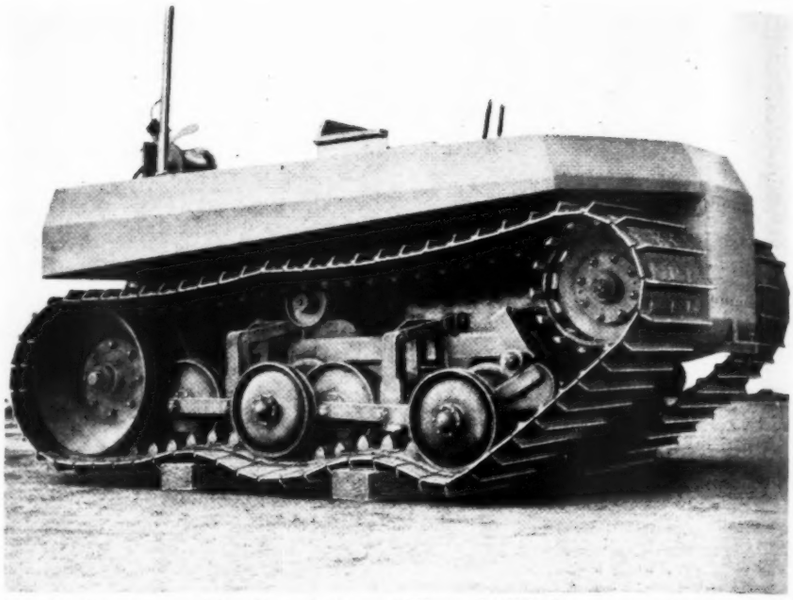
The patented Cuthbertson rubber track is able to travel over the ground easily, as it is not in tension in the lower part, the drive being taken from the front. Rectangular rubber pads of $\frac{1}{2}$-in. thickness are reinforced by endless steel cables which are free to slide over ferrules so that the track flexes freely in every direction. Steel grousers outside, and steel plates carrying driving dogs inside, connect the pads together to form the track. Full flexing is permitted by the independently mounted and spring-loaded intermediate rollers. A rear roller supports the rear weight of the tractor on the track and is itself carried on a stub axle which includes a tension-adjusting arrangement. The locating bolt for the latter is designed to shear and so slacken track tension in the event of large stones becoming trapped inside the track.

The drive sprocket is at the front (contrary to common practice) and the track top consequently is in tension and the bottom run, therefore, is free to mould itself closely to the ground undulations and so develop a ground adhesion far greater than the best previously attained.

Tracks of various widths allow this 8-ton machine to exert a drawbar pull up to 20,000 lb., whilst giving ground pressures as low as 1.5 lb./sq. in.

The machine is being used for haulage of drainage equipment, also towing sleds or slipes, which can be loaded with material for crossing soft land.

It is ideal for any contractor's problem connected with traversing unstable ground and can be used for the carriage of materials on the flat deck.



Tracks of various widths allow the 8-ton ' Water Buffalo ' to exert a drawbar pull of 20,000 lb. when giving ground pressures as low as 1.5 lb./sq. in.

Diesel Conversion Engine

A diesel conversion engine for the famous Swedish Volvo T30 series of farm tractors is being offered by F. Perkins Ltd., diesel engine manufacturers.

A tractor was exhibited at the St. Erik's Fair at Stockholm, September 1956, fitted for the first time with a Perkins L4 diesel engine rated to produce 48 b.h.p. at 1,500 r.p.m.

The Volvo company, one of the largest tractor manufacturers in Sweden, produce four tractors in its T30 range with T.V.O. and petrol power units. They are the T31, T32, T33 and T34 tractors.

The Perkins L4 diesel engine is a four-cylinder in line power unit with a bore of 108 mm. and a stroke of 121 mm. Features include a low-level camshaft, easily replaceable pre-finished wet liners and crankshaft bearings.

Root Harvester

A new root harvester was made available in England recently. It is the second implement of this type to be designed and manufactured by Root Harvesters Ltd., the first being their well-known Model ' Z '. The new machine, known as Model ' RB ', is specially designed to give maximum protection to the crop.

Details

Digger. This machine is fitted with a new type elevator web 4 ft. shorter than that on the ' Z ' Model.

Haulm remover.—The haulm remover is also shorter and much closer to the ground.

Transverse elevator.—The transverse elevator is rubber-covered and delivers the crop to a short conveyor belt which feeds the separator.

Separator.—This is an angled plain belt supported under the upper run and lying transversely of the machine.

Conveyors.—Lengthwise of the machine and side by side are two conveyor belts, one of which receives potatoes and the other clods and stones from the separator. The final cleaning of the crop is done manually on these belts, the potatoes then passing to the discharge conveyor belt; the clods and stones return to the ground.

Belt drives.—The mechanical drives are, as far as possible, by V-belts, the use of chains having been reduced to the minimum.

Hydraulic lift.—The machine may be fitted with large non-castoring front wheels for hitching direct to the tractor hydraulic lift equipment.

Weight.—The weight of the machine is below 30 cwt. and it is therefore within the capacity of almost all tractors.

Sugar beet

The single-row beet equipment and the carrot equipment as used on the Model ' Z ' are fitted without alteration.

Agricultural Chemicals

A New Zealand (South Island) contract amounting to just over £1 million has recently been placed with W. J. Fraser and Co. Ltd., of Essex, England, for a complete factory to produce 100,000 tons of superphosphate per annum. This contract is in addition to a similar one already being carried out by Frasers in the North Island, although more favourable ground conditions enable a different method of mechanical handling to be employed.

Frasers' senior staff from England will supervise construction which it is hoped to complete in just under two years to enable the spring demand for fertiliser to be met, though weather conditions in the extreme south may make this difficult.

The work will be carried out with the collaboration of Frasers' New Zealand agents, Cory-Wright and Salmon Ltd., of Wellington, and Downer and Co., also of Wellington, whom Frasers have appointed as civil engineering contractors for the work.

The factory will incorporate a sulphuric acid plant and the raw materials will be imported sulphur and Nauru phosphate rock. The factory will be built on a virgin site and involves administration buildings, rail sidings, packing and despatch facilities.

*

A new range of seed dressings has now been added to the range of agricultural chemicals manufactured by Lunevale Products Ltd., Great Britain. They are ' Lanasan ', ' Fynasan ' and ' Halasan '.

Brief specifications are:

' *Lanasan* '. — Straight organo-mercurial dressing, which is non-corrosive, practically odourless, with low volatility and ensures maximum effective control.

' *Fynasan* '.—Dual-purpose dressing with the organo-mercurial as ' Lanasan ' and with the addition of dieldrin, an acknowledged protection against wireworm.

' *Halasan* '.—Dual-purpose lindane/thiram dressing, suitable for brassica seed.

*

Chemical herbicides have become a new tool for industry to use in many places where unwanted vegetation creates a maintenance problem. Weeds and grass may become a fire hazard in dry seasons, cause slippage along railway lines, or hold enough water to make rail sleepers rot faster. Along fence lines vegetation impairs visibility and may increase the rate of metal rusting and wood decay. Weeds along the edges of pavement or between the joints may break up the surface of roads, parking lots or airport runways.

Besides causing damage and giving an area an unkempt appearance, uncontrolled vegetation may also trap rubbish or form cover for such pests as rats, snakes and insects.

It is difficult for labour crews with hand tools or even with power machinery to stay ahead of vegetation growth, especially where it is desirable to keep an area completely free of vegetation. This kind of problem has been attacked successfully with various chemicals, depending on conditions and degree of control desired. Where it is desirable to keep the ground free of vegetation, ' Telvar ' weedkillers, manufactured by du Pont, have generally given good results. These materials have been used for several seasons in the continental U.S.A. and Hawaii. They have recently proved successful for tropical use in tests in sugar-mill areas in Cuba and Brazil and have been used by the Danish States Railways.

These materials are being used by petroleum companies, railway companies, electric utilities and other types of industry throughout the world. Specific applications include: along plant security fences, railway sidings and spur tracks, roadsides, around fuel-storage and equipment yards, around wooden structures and storage areas, such as sheds, bridge trestles, lumber and timber piles. Other areas where ' Telvar ' weedkillers have been used successfully include such places as military installations, pole yards, pipelines, fire breaks, outdoor amphitheatres, pavement joints and cracks, around building foundations and on sludge beds of sewage - treatment plants.

Keeping drainage ditches free of growth offers an important use for chemical weedkillers. The chemical can control vegetation without affecting the contour of the ditch, whereas digging or scraping may cut away enough soil to affect the flow of water.

There are two ' Telvar ' weedkiller formulations—' Telvar DW ' is the newer of the two. It is based on 3-(3:4-dichlorophenyl)-1:1-dimethylurea and is especially suitable for ' soil sterilant ' applications in areas where annual rainfall runs higher than 20 in. It is usually longer-lasting than ' Telvar W ' under these conditions. ' Telvar W ', based on 3-(*p*-chlorophenyl)-1:1-dimethylurea, is recommended for many uses and has advantages over the new material for arid regions (where annual rainfall is less than 30 in.).

Both materials are wettable powders and are applied as a suspension in water.

Wettable powders minimise bulk, save in transportation, handling and storage costs and also eliminate danger from spilling, leakage and fumes often associated with liquid materials.

*

In conjunction with the tableting and pelleting service provided by Thompson and Capper Wholesale Ltd., they are also able to supply certain catalysts in tablet form, particularly tablets of potassium sulphate and copper sulphate for Kjeldahl determinations of nitrogen. These Kjeldahl tablets are used in the nitrogen determinations for crops and meals of all kinds.

The pellets supplied contain a fixed weight of potassium sulphate and the other ingredients, such as copper sulphate, selenium, mercuric oxide etc., thus making the whole process of the estimation very much simpler and cleaner in every respect. Instead of the analyst having to measure out a quantity of potassium sulphate plus some other ingredients, all he does is simply add one or two of the tablets to his determination flask.

*

Next to sulphuric acid, soda ash (sodium carbonate) is probably the most widely used of all of the so-called heavy chemicals. Soda ash is the principal source of chemical alkali and has a wide and diversified use in industry.

' Trona ' soda ash, a manufactured product, has been produced since 1934. During the intervening years American Potash and Chemical Corporation has

taken advantage of all available technological and equipment advances. Their extensive research facilities are continually engaged in the field of product improvement.

The measure of commercial quality of soda ash is designated as 58% Na_2O (sodium oxide), although such factors as impurities, iron, granule size and appearance enter into the grading and appraisal of a quality chemical.

' Trona ' soda ash is manufactured in two types, which are marketed as ' Trona ' granular soda ash (light) and ' Trona ' fine granular soda ash (dense). Both types are identical in chemical composition, but vary in screen size and density. Although ' Trona ' soda ash is guaranteed at 58% Na_2O (sodium oxide), a typical analysis reveals that the products analyse considerably in excess of this commercial standard.

Analaysis

Na_2O, 58.26; Na_2CO_3, 99.61; Na_2SO_4, 0.24; NaCl, 0.17; H_2O, 0.15; insoluble matter, excluding Fe, 0.0012; total iron as Fe, 0.0018%.

*

' Colloidox ' is a true colloidal copper oxychloride fungicide, containing 20% metallic copper by weight. The individual particles are so small that they cannot be detected under a normal microscope and specially powerful equipment has to be used.

The extreme fineness results in unrivalled powers of suspension. For instance, when mixed with water, only 1.2% of the ' Colloidox ' settles out after 30 minutes, and only 8% after 24 hours. As a result it is possible to leave ' Colloidox ' solutions in spray tanks for a very long period and, furthermore, agitation is not necessary when spraying.

Another result of this fineness is the remarkable fungicidal powers of ' Colloidox '. Not only does the even dispersion and suspension in water ensure a complete and even distribution on the foliage, but, since the relative fungicidal activity depends on the size of the individual particles, much less is needed to give the same protection.

' Colloidox ' can be applied in any volume of water and can be used in any make of spraying machine. Because of its qualities it can be used with the lowest volume sprays with no fear whatsoever of causing nozzle or filter blockage. No nozzle exists which is too fine to let ' Colloidox ' through.

This fungicide, which is especially useful against potato blight and downy mildew of hops, is manufactured in England by Chisholm, Fox and Garner Ltd.

*

The Murphy Chemical Co. have just issued a new leaflet on the chemical sterilisation of glasshouse soils. The leaflet lists a number of effective general soil sterilisers, such as Novo, ECA and formahaldehyde, and gives directions for the treatment of soil in glasshouses, pots and boxes and for potting soil. Advice is also given on the washing down of glasshouses and mushroom houses and recommendations are made for the control of root-knot eelworm on tomatoes.

*

HEPT and TEPP are phosphate insecticides manufactured by Albright and Wilson Ltd. and which are used for the control of aphides, mites and other plant pests in hop gardens, orchards, fruit farms, market gardens and glasshouses.

HEPT and TEPP are similar in composition and behaviour and, although it was originally thought that hexaethyltetraphosphate showed insecticidal activity of its own, it is now known that HETP depends mainly—although not entirely—on its content of tetraethylpyrophosphate for this activity. Qualitatively, they may be considered as having the same insecticidal properties, although quantitatively TEPP is more potent than HETP.

Extensive field trials and large-scale commercial experience have now established their effectiveness. They are most useful for the control of the active stages of aphides and mites; the evidence available indicates that they may be applied at any time during the growing season without causing damage to the plants or affecting the quality of the crop. HETP and TEPP effectively replace nicotine for the control of aphides and have been found to maintain their efficiency better than nicotine when used in cold weather. They are particularly useful on strawberries and other soft fruit and on lettuces which are grown under cloches, Dutch lights or in unheated glasshouses. They are also useful against other insect pests, including greenhouse white fly, mealy bugs, scale insects and thrips.

HETP and TEPP are compatible with most formulations of benzene hexachloride (Gammexane), DDT, chlordane, neutral copper sprays and wettable sulphurs. They are not compatible with alkaline materials, such as lime sulphur and bordeaux mixture.

Reader Service

For further information on any item reviewed in this section please write to :

Reader Service
WORLD CROPS,
Stratford House,
Eden Street, London N.W.1,
England

Flora of Central Africa

The Government of Portugal, the Federation of Rhodesia and Nyasaland and the U.K. are collaborating in the preparation of a Flora of Central Africa to cover Mozambique, the Rhodesias, Nyasaland and Bechuanaland.

The work will be carried out by botanists drawn from the participating countries, working at Kew, the British Museum and in Portugal, and supported by collectors in the field in Central Africa. A Senior Botanist from Southern Rhodesia has already been working in London for some months on the project in collaboration with officers of the British Museum and the Royal Botanic Gardens. It is hoped in due course to build up a staff of botanists working full time on the project and the first vacancy has recently been advertised in Britain.

Parts of the work will be published as they are prepared and are expected to meet a long-felt local need for a comprehensive authoritative botanical work on this region, in addition to being of general scientific value and interest.

Botanists are already working at Kew on a Flora of tropical East Africa and a Flora of tropical West Africa, parts of which have already been published.

WORLD CROP REPORTS

ARGENTINA

A bumper harvest is forecast in Argentina following recent rains over nearly all of the country.

Maize sowings continued to be very active during the week to 5 October.

IRAN

Almonds.—The 1956 Iranian almond crop is now forecast at 5,000 short tons, shelled basis. This is substantially higher than earlier estimates, but still below average. The five-year average (1949–53) is 7,400 short tons. The 1955 crop has been estimated at 4,400 tons. Recent reports from Azerbaijan and Khorassan, north-west and north-east Iran respectively, indicate less damage from frosts this spring than was previously estimated.

Exports from Iran for the period August 1955–March 1956 totalled 3,350 short tons, shelled basis. Nearly all of the exports were in the form of shelled almonds. It is now anticipated that exports for the entire 1955–56 season will total about 3,600 tons. Consumption within Iran has declined sharply in consequence of the high prices which resulted from the short crops in Iran and other foreign countries.

India and Germany were by far the largest customers in 1955–56, taking 1,372 and 1,334 short tons of shelled almonds respectively.

U.S.A.

Mr. C. M. Galvin, of Francis L. Dupont and Co., estimates U.S. production of soya beans this year at 464,908,000 bushels based on 1 October conditions.

Maize production as at 1 October is estimated at 3,317,370,000 bushels and spring wheat, including durum, at 246,271,000 bushels.

AUSTRALIA

Wheat farmers in northern New South Wales, who had already lost up to half their crops because of flood waters, urgently needed rain to save hundreds of thousands of bushels of ripening grain.

A spokesman for the New South Wales Department of Agriculture said, on 9 October, that flood waters earlier in the year, spreading over hundreds of square miles of farm lands, had delayed the sowing of the wheat crop. Strong winds later had dried up the land quickly, so that some farms were suffering from semi-drought conditions, with dry, baked earth, the spokesman added, and rain would have to come within the next two weeks to save the crops.

EUROPE

Peas.—The 1956 pea production in the United Kingdom was expected to be above average in quantity, but of poor quality, due to the late wet harvesting season. Similar conditions were reported in Belgium. Damage to dry peas in the Netherlands was reported earlier. These three countries together produced 6.3 million bags of the 8.6 million bags of peas produced in all Western Europe in 1955.

Although it has been reported that carry-over stocks in some European countries were fairly heavy this year, imports of U.S. peas may be needed in the 1956–57 marketing season.

For. Crops & Mark.

European crop prospects

The better weather since August revived farmers' hopes throughout Europe that this year's harvest, though poor compared with previous years, will not be as disastrous as they feared during August's heavy rains.

But, although the total will not be so low, the quality of many crops has suffered severely. Much corn will be fit only for animal fodder and many countries expect bigger imports this winter to make up the deficiencies.

No geographical division can be traced. Austria had good weather this summer and a good harvest is expected. Neighbouring Switzerland's prospects are ' generally gloomy '—in some parts the worst within living memory.

A round-up from European capitals revealed the following:

Austria.—A good harvest expected, in quality better than last year.

Belgium.—Belgium will have to import 150,000 tons more wheat from the U.S.A., as the August rains ruined some crops. Generally, however, farmers harvested successfully, though a fortnight late.

Denmark.—The total harvest is estimated to be slightly higher than average and the farmers are ' quite happy '. Grain imports are expected to be lower than last year, when the harvest suffered from drought. The latest estimates put the total grain crop at 4.5 million tons, compared with an average of 4.3 million. Sugar-beet and fodder root crops are reported to be 10% higher and the grass, hay and green fodder crops are about 10% lower.

Finland.—The rains delayed the harvest, which could not be brought in before the night frosts began in September, and damaged it further. Farmers have appealed for Government financial aid, but it is too early yet to say whether extra imports will be needed.

France. — French agriculture has made ' a remarkable recovery ', but farmers' hopes place the wheat at 7 million tons, compared with 10 million tons last year. Wheat imports are expected to reach 2 million tons this year to maintain the traditional exports of flour.

East Germany. — No figures of damage have been released, but the situation is particularly serious in the potato fields. All available manpower has been mobilised to help farmers, but the delayed crops are already threatened by early frosts.

West Germany.—Prospects are 'much brighter'. Both the potato and grain crops should be slightly higher than last year. Imports should not greatly exceed last year's according to an Agricultural Ministry spokesman.

Italy.—Farmers expect the harvest to be ' generally satisfactory '. The wheat harvest is expected to total 8 million tons, compared with last year's record of 9.5 million tons. The greater part of this is made up of soft wheat, of which there is already a large surplus from last year. Imports of hard wheat are expected to be necessary. The worst affected crop is olives, making increased imports of olive oil necessary. This year's crop has been estimated at about 140,000 tons, compared with 180,000 tons last year. The maize harvest is not expected to exceed last year's total of 3,200,000 tons and a normal rice crop is likely, although proportionately lower, since the area

sown to rice has been reduced this year. Vines, which suffered in the winter, are expected to produce slightly less than last year's total of 1,298 million gallons of wine.

Norway.—Farmers expect the corn to be of poor quality and much of the wheat fit only for animal foods, but barley seems to have survived the wet better than the others.

No estimate has yet been made as to whether increased imports will be necessary or not.

Sweden.—In spite of the delay, crop prospects are better. The Swedish Agricultural Board said that it was almost certain that Sweden would have a surplus of some 200,000 tons of cereals, some of which would be available for export. The total cereal crop was estimated at 1,144,000 tons, including 881,000 tons of wheat and 263,000 tons of rye. Fodder seed crops this year are expected to be at the record level of 2,328,000 tons, or 796,000 tons higher than last year. The surplus is expected to amount to 100,000 tons.

Switzerland.—Imports will be higher than usual. Where grain and hay crops have been saved they are of low quality, and vegetable fields, orchards and vineyards have suffered extensive damage.

TUNISIA

The Tunisian wheat crop season, which began on 1 July, is expected to be about 100,000 tons short of wheat, according to first estimates by the French Secretary of State for Agriculture here today.

The barley crop was also expected to be about 60,000 tons short.

There will be a surplus of about 30,000 tons of wheat durum. Last year's Tunisian deficit of wheat had been covered by metropolitan wheat to the extent of 73,000 tons. All surplus of Tunisian durum is absorbed by France for four years following the Franco-Tunisian common grain market agreement signed in April 1954.

ENGLAND AND WALES

Agricultural conditions in England and Wales on 1 October, 1956, have been summarised by the Ministry of Agriculture, Fisheries and Food.

By the end of September about 90% of the cereal crops had been harvested. The condition of harvested wheat, barley and rye is variable, but generally fair. Oats have suffered most from the weather and the condition of this crop is generally poor. Yields per acre of wheat, barley and rye are now expected to be better than in 1954 and about the same as the average of the five years 1950–55, but yields of oats and mixed corn will be below average. Only a small proportion (about 0.3%) of the total cereals acreage is likely to be abandoned.

Some second early and maincrop potatoes are seriously affected by blight. Root crops made good growth and yields per acre are expected to be about average.

The latest estimates of yields per acre of hay are considerably below average.

Grass was plentiful; cattle and sheep have done well on the whole.

Weather conditions

The weather during the first 12 days of September was rather cool and cloudy with outbreaks of rain, many of them heavy with thunderstorms at times. Mainly dry weather followed with fine spells in most places and higher temperatures, although several days of thundery rain were experienced in some western districts at the end of the third week. Unsettled weather returned during the last few days of the month, bringing heavy rain in places and high winds. Rainfall was above average for the month and sunshine was deficient in practically all areas.

Cereals and pulses

The better weather during the month enabled good progress to be made with the harvest in most areas. Forecasts of average yields per acre as at 1 October, on the assumption of normal weather conditions from that date, are given below.

Wheat.—Good progress was made with the harvesting of wheat and 89% of the crop has been gathered. Much grain has required drying. Some of the harvested grain is discoloured and sprouted, but the quality generally is fair. The unharvested crops are mostly spring sown, which have been slow to ripen; they are standing fairly well. Sprouting has occurred in many districts.

The yield of wheat is expected to be 23.3 cwt. per acre, as compared with a five-year average of 23.5 cwt. and a yield of 26.7 cwt. in 1955 (22.6 cwt. in 1954).

Barley.—In many areas the harvesting of barley was almost finished, the proportion of the crop harvested at the end of September being 92%. The moisture content was high. Much of the harvested grain is discoloured, some sprouting has occurred, but the quality generally is fair. Most of the ungathered crops are badly laid and in some cases undersown seeds and weeds have grown through. Sprouting is reported.

The yield is forecast at 21.9 cwt. per acre, as compared with a five-year average of 21.9 cwt. and a yield of 25.4 cwt. in 1955 (21.4 cwt. in 1954).

Oats.—Oats, of which 81% of the crop had been harvested, are generally disappointing and are the poorest of the cereal crops. Much of the harvested grain is discoloured and some sprouting has occurred. Considerable losses due to lodging and shedding are reported. The quality of the grain is only fair to poor. A large part of the unharvested area is badly laid and has sprouted.

The yield is expected to be 17.6 cwt. per acre, as compared with a five-year average of 20.3 cwt. and a yield of 22.5 cwt. in 1955 (19.2 cwt. in 1954).

Mixed corn.—The proportion of mixed corn harvested was 80%. Grain has a high moisture content and sprouting has occurred; much grain has been lost through shedding. The quality generally is fair to poor. The condition of the unharvested crops was generally poor; many fields were badly lodged and there is much loss of grain through shedding.

The yield per acre is expected to be 18 cwt. per acre, as compared with a five-year average of 20.2 cwt. and a yield of 22.1 cwt. in 1955 (18.4 cwt. in 1954).

Rye.—Good progress was made with the harvesting of rye and 96% of the crop had been gathered in satisfactory condition. On the whole, the quality of grain is fair to good. The condition of the small acreage remaining unharvested was generally satisfactory.

The yield per acre is expected to be 19.5 cwt. per acre, as compared with a five-year average of 19 cwt. and a yield of 20.4 cwt. in 1955 (18.5 cwt. in 1954).

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WORLD CROPS

VOLUME 8, 1956

INDEX

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WORLD CROPS INDEX

VOL. 8 • 1956

A

Accidents, farm (*ed*) . . . 95
Accommodation for students in Nyasaland 157
Achatina fulica Bowdich, control of . 233
Advances in Agronomy (*br*) . . 205
Aerial application of fertilisers (*ed*) . 169
Afforestation in Asia (*ed*) . . 464
Afghanistan, sugar-beet crop in . 21
Africa, central, Colonial Development Corporation activities in . . 353
flora of 502
East, Colonial Development Corporation in 352
pyrethrum in 106
soil erosion in (*ed*) . . . 295
African agricultural plan . . 195
Agrarian changes in Yugoslavia . 153
Agricultura, a review . . . 113
Agricultural Botany, National Institute of 83
chemicals . . . 459, 501
College, Nyasaland . . . 157
crops in Hawaii . . . 114
developments in Fiji . . . 187
Ecology (*br*) 243
Economy of the Danubian Countries, 1935–45 (*br*) . . . 160
hazards (*ed*) 213
machinery, restricted buying of, in France 159
policy in Poland (*ed*) . . . 171
production, 1954–55, world: and outlook for the immediate future 5
world, increased (*ed*) . . 419
progress in Canada . . . 235
in Hungary 182
prosperity in Mexico . . . 183
research 239
Council, problems of research (*ed*) 51
resources of the world (*br*) . . 201
Agriculture and atomic energy (*ed*) . 254
Chinese (*ed*) 50
contributions of atomic energy to (*ed*) 463
development of, in West Germany 15
economics of (*ed*) . . . 214
hazards from toxic chemicals in . 365
in Colombia 407
in Czechoslovakia . . . 146
in Haiti (*br*) 87
in Hawaii 63
in West Germany, changes in . 306
income from (*ed*) . . . 96
Israeli, exhibition of . . . 242
note on, in Latin America . . 112
safety precautions for (*ed*) . . 128
South African, development of . 20
tropical, weed problem in . . 227
world economic situation (*ed*) . 419
role of systemic insecticides in . 364
weed problems in . . . 217
Air, farming from the . . . 148
-blast vine sprayer . . . 338
lines, oil and water separator for (*me*) 378
Aircraft, agricultural (*me*) . 455, 497
new-type 149
See also Helicopter
Akrit in Israeli peanut fields . . 488
Ammonia, anhydrous, for the use of non-irrigated crops (*ed*) . . 129
Animal production, FAO research . 468
Antarctic expedition, fertilisers for . 80
Antigua, ' Supertrac ' in . . 482

Editorial Comment (*ed*); New Books (*br*); Machinery and Equipment (*me*); Correspondence (*corr*); Errata (*err*)

Apple crop survey, OEEC area, 1956–57 season (*ed*) . . . 463
Apples, effect of land cultivation on (*ed*) 384
Argentina, wheat prospects . . 438
Arid Zone Research, UNESCO Advisory Committee for . . 11
zones, water requirements of . 339
Asia, agricultural production in, in 1954–55 7
possibility of eucalypts to provide fuel and timber (*ed*) . . 464
Atomic energy (*ed*) . . . 463
and agriculture (*ed*) . . . 254
Commission, U.S., new radio-isotope farm (*ed*) . . 465
energy's contribution to agriculture 277
radiation, peanuts and . . 119
Atoms for seed (*ed*) . . . 1
Australia, fodder conservation in . 431
grasshopper plague in (*ed*) . . 49
myxomatosis in (*ed*) . . . 50
new rice plan 367
Northern Territory rice project . 482
rice industry in 40
Snowy Mountains Scheme . . 483
solving the brush problem in . 38
spraying project in . . . 259
The Wheat Industry in (*br*) . . 452
wheat-farming costs in . . 431
developments in . . . 428
Australian machinery exports . 427
Automation in orchards (*ed*) . . 331

B

BHC, effect of, on earthworms (*ed*) . 170
Bactericides, systemic fungicides and 364
Bahamas, agricultural venture in the 107
Bananas, cultivation of, in Fiji . 189
in Hungary 369
Barley, acreage and production of, in Canada 235
beer variety, in Hungary . . 201
malting varieties . . . 235
production in Cyprus . . 281
radioactive treatment for . . 319
special varieties of, in Canada . 236
Basic slag (*ed*) 98
Basutoland, Colonial Development Corporation activities in . . 353
Battery, fence (*me*) . . . 290
for Ferguson tractor (*me*) . . 378
non-spill fence (*me*) . . . 91
Bechuanaland, Colonial Development Corporation activities in . . 353
Beer, brewing of, in America (*ed*) . 51
Beet, seeder and thinner for (*me*) . 499
Benweed, treatment of, in Northern Ireland (*ed*) 333
Bessemer steel process (*ed*) . . 98
Bhakra-Nangal Project . . . 74
Biological control of the giant African snail in Hawaii 233
Black pod in Nigeria . . . 302
Blackarm disease of cotton and its control 362
Blade-type plough shares (*me*) . 245
Boga medeloa 261
Brazil as market for agricultural tractors 449
German tractor factory for . . 200
Bread, new research station in Ireland (*ed*) 419
British fertiliser consumption (*ed*) . 466
machinery exports (*ed*) . . 421
industry, state of (*ed*) . . 333
Society for Promotion of Vegetable Research (*ed*) . . . 331
See also under U.K.
Brush problem, solving the, in Australia 38
Brussels-sprouts sprayer (*me*) . . 165
Bulgaria, co-operative farms in . 274
developments in agriculture . . 273
Bulgarian countryside, changes in . 276
' Bulkfeed ' wagon (*me*) . . . 209
Bunt, breeding wheat resistant to . 432

C

C.A.B. *See* Commonwealth Agricultural Bureaux
Cabin, tractor (*me*) . . . 290
Cacao, production of, in Malaya . 181
Cactoblastis cactorum, control of prickly pear with . . . 401
Cameroons, Southern, cocoa plantation in 241
Canada, agricultural production in, in 1954–55 6
barley crop in 235
wheat areas and varieties . . 423
breeding and production in . 423
Capping of soil 445
Caribbean, Colonial Development Corporation in the . . . 352
Cash economy in the West Indies . 174
Caterpillars, liquefying of (*ed*) . 127
Centre for Plant Physiological Research, Holland . . . 400
Cephus cinctus. *See* Sawfly
Ceratitis capitata. *See* Mediterranean fruit fly
Cereal cultivation in U.S.S.R. . 316
resistance to powdery mildew fungus 206
Cereals, development of, in France . 60
in Sarawak 56
weedkillers in 218
Cetyl alcohol, reduced evaporation loss with 369
Ceylon, replanting costs for tea . 270
rice mechanisation in . . . 405
sugar factory for . . . 206
tea-soil management in . . 392
Chain saw, electric (*me*) . . 91
Chemicals, use of, for land clearing . 141
Chemistry, Applied, Reports on the Progress of (*br*) . . . 43
Chesterford Park Research Station . 494
Chile, tractor factory for . . 200
China, agriculture in (*ed*) . . 50
reclamation project (*ed*) . . 170
Chinese irrigation scheme . . 262
Chlorella farming, role of solar energy in 399
3-(*p*-Chlorophenyl)-1:1-dimethylurea, weedkiller based on . . 501
Citrus crops in Cyprus . . . 400
orchards in Kenya . . . 190
production of, in South Africa . 21
world 242
Climate and soils in Nyasaland . 255

Clover, weedkiller for use in . . 220
Clutch, combined, and p.t.-o. (*me*) . 290
Cocoa, development of, in Sarawak . 57
experiments, factorial arrangements for 359
Farmers, Nigerian (*br*) . . 373
field experiments with, on Gold Coast 355
forecast for 10
plantations in Southern Cameroons 241
Coconut in Sarawak . . . 56
plantations in Travancore-Cochin, increased productivity of. . 317
Coconuts, collection, husking and splitting of 489
Coffee, development of, in Sarawak. 57
production of, in Hawaii . . 118
in St. Helena 14
forecast for 10
Colombia, agricultural situation in . 407
Colonial Development and Welfare in West Indies (*ed*) . . . 3
Corporation, work of . . 350
research (*ed*) 52
Colonisation in Spain . . . 441
Colorado River scheme . . . 186
Combine-harvester (*me*) . . 377
experimental, designed by N.I.A.E. 479
mounted (*me*) 498
self-propelled (*me*) . . . 207
Commodity studies by FAO . . 470
Commonwealth Agricultural Bureaux (*ed*) 169
administration of. . . 474
finance of 474
organisation of . . . 472
publications of . . . 474
work of 473
Computor for sprayers (*me*) . . 163
Conference, Commonwealth Agricultural Bureaux (*ed*) . . . 160
Conveyor, grain (*me*) . . . 248
pneumatic (*me*) . . . 376
Co-operative farms, character of . 275
in the U.S.S.R. (*ed*) . . 172
Co-operatives in Yugoslavia . . 368
lack of machinery, in Yugoslavia . 153
Copper as a nutrient for tobacco (*ed*) 333
oxychloride fungicide . . 502
Copra kiln, operation of. . . 490
small, description of . . 436
manufacture of, in the Pacific Islands 42
marketing of 491
production by the smallholder 435, 489
raw, spoilage of . . . 489
See also under Coconut
Corn and Corn Improvement (*br*) . 42
Corn, more, per acre (*ed*) . . 129
Cotton, control of blackarm disease . 362
cultivation in Thailand . . 312
difficulties in Rhodesia and Nyasaland (*ed*) 382
-growing in Kenya . . . 200
Problems (*br*) . . . 120
production forecast for . . 10
Couch, control of 221
Coupling, tractor (*me*) . . . 90
Crawler tractor (*me*) . . . 92
Crop dryer, portable (*me*) . . 458
insurance provided by U.S. Department of Agriculture . . 477
-protection chemicals, residual effects of, in soil . . . 366
genetics in relation to . . 362
in Yugoslavia . . . 443
world aspects of . . . 361
reports. *See* World Crops Reports
sprayer (*me*) 90
Crops, Cultivated, Common, of South India (*br*) . . . 495
increased output of, with shelter belts (*ed*) 331
industrial, in Poland . . . 202
Crops, protection of (*ed*) . 213, 230
Cultivation of orchards . 336, (*ed*) 384
Cultivator, rotary (*me*) . . . 247
Cutter, rotary (*me*) . . . 163
Cutters, tree 138
Cyprus crop report . . . 372
improving citrus crops in . 400
reclamation of eroded lands in . 407
wheat and barley production in . 281
Czechoslovakia, rice in . . . 146

D

2,4-D, weed control experiments with (*ed*) 381
DDT, effect of, on earthworms (*ed*) . 170
Dairy farm costs in Dorset . . 251
Dalton Lecture, ninth . . . 118
Damascus International Trade Fair 244
Danish agriculture, future problems in 238
Dawaki Tofa, grass trials in . . 132
Denmark, fodder crops in . . 448
increased productivity in . . 238
Dextran, use of, for soil conditioners (*ed*) 127
3 - (3:4 - Dichlorophenyl) - 1:1 - dimethylurea, weedkiller based on . 501
Diesel conversion engine (*me*) . 500
Digger, potato (*me*) . . . 209
trench (*me*) 377
Diseases and pests in Cyprus, control of 283
Disk plough for eradication of shrubs 131
Distillation apparatus, solar . . 241
Doors, roll-up (*me*) . . . 92
Drainage for sugar-cane land . . 310
Drier, crop, portable (*me*) . . 458
grain (*me*) 291
Drill, seed (*me*) 245
-spacing (*me*) . . . 415
Dutch reclamation scheme (*ed*) . 334
See also under Netherlands *and* Holland

E

Earthmoving equipment for Track-Marshall (*me*) 456
Earthworms, effect of DDT and BHC on (*ed*) 170
Eating habits, change in (*ed*) . . 332
Economics in world agriculture . 214
wine-growing 144
Edinburgh, Duke of, at Jealott's Hill 242
Education, agricultural, by U.S. Department of Agriculture . . 478
'Electrall' power system (*me*) . 210
Empire Cotton Growing Corporation 108
England and Wales, crop production (*ed*) 171
Entomology in Venezuela . . 106
Equipment, application, for use with aircraft 149
Eroded lands, reclamation of, in Cyprus 407
Erosion, checking of, in Australian wheat areas 430
control of, in Japan . . . 191
of soil in Africa (*ed*) . . . 295
prevention of 133
Ethiopia, Nile waters and . . 206
Point IV mission in . . . 328
Eucalypts, possibility of planting programmes in Asia (*ed*) . . . 464
widespread stands of . . . 427
Europe, East and West, and the U.S.A., forestry statistics in (*ed*) . 129
Western, agricultural production in, in 1954–55 . . . 6
European grass-seed situation. . 403
Evaporation, use of cetyl alcohol to reduce, from water storages . 369
Evolution, Features of, in the Flowering Plants (*br*) 452
Excavator, versatile (*me*) . . 208

F

FAO commodity studies . . 470
Economics Division . . . 470
field operations 467
finances of 467
Fisheries Division . . . 470
land and water use . . . 469
measures taken by, against locusts 80
publications 471
resignation of Dr. Cardon (*ed*) . 252
work of 467
world surveys by . . . 469
Fallow land, groundnut-shell-mulching of 68
Far East, Colonial Development Corporation in the 352
Farm, accidents on the (*ed*) . . 95
adoption scheme (*ed*) . . . 130
advisory services (*ed*) . . . 332
bill veto in the U.S.A. (*ed*) . . 254
Buildings (*br*) 454
land, poor quality, in West Indies 173
machinery in the U.K. (*ed*) . 127
price review (*ed*) . . . 252
safety (*ed*) 420
surplus in the U.S.A. (*ed*) . . 251
work study (*ed*) 422
workers, fatigue studied (*ed*) . . 419
Farmer Co-operative Service of U.S. Department of Agriculture . . 477
'Farmers' Boy' Major (*me*) . . 291
Farming from the air, American experience 148
in high country (*ed*) . . . 3
in Russia (*ed*) 128
mixed, in the West Indies . . 176
steel centenary and (*ed*) . . 98
West German (*ed*) . . . 4
Fatigue in farm workers (*ed*) 420, (*ed*) 422
Fats and oils, production of, in France 61
Fence battery . . (*m*) 91, (*me*) 290
Fencing, electric, for control of animals 81
Ferguson 35. 492
Fertiliser, ammonium sulphate as a, in Japan 194
application of, in West Germany . 16
consumption, U.K. (*ed*) . . 466
experiments on rice . . . 348
factory expansion for, in Rhodesia 62
situation, OEEC Committee on . 182
Fertilisers, aerial application (*ed*) . 169
and irrigation (*corr*) . . . 89
animal health and (*ed*) . . 49
application of, in Northern Nigeria 132
with aircraft 149
for Antarctic Expedition . . 80
in rice production . . 345, 346
liquid (*ed*) 129
new 142
report on, 1953–56 (*ed*) . . 297
urea–formaldehyde (*ed*) . . 421
use of, in Hawaii . 65, 114, 118
in Swaziland 72
in U.S.S.R. 315
in West Indies . . . 175
Fertility, seaweed for . . . 285
Fibres, hard, production forecast for 10
Fine chemicals for horticulture and agriculture 11
Fish, pond, development of, in Sarawak 58
Fisheries, FAO advisory work on . 470
Fiji, agricultural developments in . 187
production increase in . . 188
Flag smut, breeding wheat resistant to 433
Flora of Central Africa . . . 502
Flour, new research station in Dublin (*ed*) 419
Flow indicator, spout (*me*) . . 376
Fluorescent fitting, new . . . 186
Fodder conservation in Australia . 431
crops in Denmark . . . 448

Fodder trees for sheep (*ed*) . . 216
Food consumption of world countries 340
losses by spoilage and waste . 304
production, world, increase of (*ed*) 419
supplies, factors affecting the world's 303
Foodstuffs, residues from pesticides in 366
Forage harvester (*me*) . . . 414
Forest improvements in Malaya . 412
reserves in Southern Rhodesia . 494
trees, effect of, on cocoa production 356
Forestry development in Stapleford, South Africa 262
exhibition in Stockholm . . 321
Seminar in U.S.S.R. . . . 372
statistics (*ed*) 129
Forests, Malayan 494
scope for increased planting in Wales (*ed*) 420
See also under Timber etc.
Formosa, developments in . . 203
France, agricultural situation . . 158
crop damage by frost (*ed*) . . 171
development in . . . 59
Southern, irrigation in (*ed*) . . 1
French agriculture, mechanisation in present conditions and future outlook for . . . 59
report on 408
during 1955 . . . 318
wine-growing in . . . 143
farmers' financial grievances (*ed*) . 298
wine-growing industry, progress in 143
Frost damage to French crops (*ed*) . 171
Fruit (*br*) 120
development of, in Sarawak . 57
grading 338
-growing in Poland . . . 344
in Hawaii 117
in South Africa . . . 320
production of, in South Africa . 20
ripening of, by atomic radiation . 397
Fungicide, copper oxychloride . 502
Fungicides, mechanism of toxicity of 364
mechanisms of toxicity with reference to fungicides . . . 363
systemic, and bactericides . . 364

G

Gall Midges of Economic Importance (*br*) 287
Game and the farmer . . . 205
and vermin animals, control of . 81
Genetics, Advances in . (*br*) 43, (*br*) 373
in relation to crop protection . 362
German mower 206
tractor factory for Brazil . . 200
transfer 202
Giant African snail, control of . 233
Girdle, tractor-tyre (*me*) . . 209
Gold Coast, Colonial Development Corporation activities in . . 353
field experiments with cocoa on . 355
Grading of fruit 338
Grain conveyor (*me*) . . . 248
pneumatic (*me*) . . . 376
drier (*me*) 291
-drying research by N.I.A.E. . 479
moisture tester (*me*) . . . 375
Grass grub in pasturelands, control of (*ed*) 170
-seed and weed control (*ed*) . . 381
situation in Europe . . 403
Grasses, perennial, control of . 221
splitting up and transplanting of . 132
Grasshoppers, plague of, in Australia (*ed*) 49
Grassland = cheaper food (*corr*) . 39
problems 219
' topping ' of (*ed*) . . . 296
Greenhouse, shatterproof (*me*) . 457
Greenland, quinoa cultivation in . 477
Groundnut-shell-mulching of fallow land. 68
Growth regulation measured with radioisotopes 279
Guiana, British, new development programme in 182
rice-cultivation experiments in . 40

H

Hardiness of Plants, The (*br*) . . 495
Hardwood cuttings, propagation by 309
Harrow, disk (*me*) . . . 122
tandem, mounted (*me*) . . 164
offset 141
Harvester, combine (*me*) . . 377
forage . . .(*me*) 124, (*me*) 414
root (*me*) 500
Harvesting of sugar-cane in Hawaii . 66
potato (*ed*) 215
Hawaii, agricultural crops in . 63, 114
biological control of the giant African snail in . . . 233
crop development in . . . 63
Haymaking, new methods of, in Sweden 446
Hazards from use of toxic chemicals in agriculture 365
Health, effect on, of pesticide residues in foodstuffs 366
Heat therapy in treatment of virus diseases 393
Heater, infra-red (*me*) . . . 210
Heda Oya irrigation project . . 234
Hedgerow timber as a crop (*ed*) . 172
Helicopter, agricultural . . . 222
Hemp, New Zealand . . . 12
Hogsheads, plywood (*me*) . . 122
High-ball clearing. 140
Hoe, garden, new-type (*me*) . . 456
Holidays for farm workers (*ed*) . 422
Holland, new reclamation scheme (*ed*) 334
See also under Netherlands *and* Dutch
Hong Kong, British equipment in . 488
Horses, Netherlands (*ed*) . . 128
population decline (*ed*) . . 383
Horticultural equipment research by N.I.A.E. 481
Humus, use of, in Hawaii . . 118
Hungary, agricultural progress in 77, 182
bananas in 369
irrigation in (*ed*) . . . 98
produces a new beer barley . 201
soil-improvement programme in . 11
Hypochlorite, plastic package for (*me*) 413
Hypomagnesaemia, increase of, in Britain (*ed*) 49

I

Idling control (*me*) . . . 245
Immunity, physiology of, of some agricultural plants . . . 362
Implement shed (*me*) . . . 245
supplies, Lanz (*me*) . . . 247
India, commercial selection and breeding of tea in . . . 263
soil conservation conference . 319
management in . . . 392
South, Common Cultivated Crops of (*br*) 495
Soviet tractors for . . . 142
sugar-cane technologists' conference in 145
tobacco research in . . . 372
Infertile areas in Northern Nigeria, reclamation of 131
Infra-red heater (*me*) . . . 210
Insect pests recorded in South Pacific territories . . . 204
Insecticidal fog, use of . . . 78
Insecticides, application methods against desert locusts . . . 367
mechanisms of toxicity of 363, 364
phosphate. 502
Insecticides, systemic, role of, in world agriculture . . . 364
use of, in West Indies. . . 175
Institutions, agricultural, FAO advisory work on 469
International Federation of Agricultural Producers, Ninth General Conference 259
Plant Protection Conference, Second Convention, Russia and Norway join 313
Union of Forest Research Organisations, congress (*ed*) . . 331
Irradiation, effect of, on peanuts (*ed*) 51
Irrigation and fertility practices . 386
corn (*ed*) 129
facilities to be provided by Snowy Mountains Scheme. . . 483
in southern France (*ed*) . . 1
Hungarian scheme for (*ed*) . . 98
in frames, automatically controlled 308
methods 387
overhead 134
practices in Spain . . . 440
relation of moisture control to crop yields 385
rice 146
scheme in China . . . 262
in Inyanga 471
in Malaya 142
treatment of salt and alkaline soils 388
use of, in Hawaii . . 65, 114
in India 76
Isotope farming (*ed*) . . . 465
Israel, shelter-belt trials in (*ed*) . 332
state of agriculture in . . 22
Israeli exhibition of agriculture . 242

J

Japan, erosion control in . . 192
experience in protective planting . 192
rice in (*ed*) 1
Jealott's Hill Research Station, Duke of Edinburgh at . . . 242
Jute cultivation in Thailand . . 312
production forecast for . . 10

K

Kale as Danish fodder crop . . 448
Kenya, citrus orchards in . . 199
cotton in 200
' Killer Kane ' (*me*) . . . 292
Kjeldahl determination, reagents for 501
Knapsack containers, use of . . 231
Kolkoz structure in U.S.S.R. . . 409

L

Labour in the Nyasaland tea industry 257
Land-clearing equipment, designs in 137
leveller (*me*) 458
limitation in Yugoslavia . . 368
Man and the (*br*) . . . 411
ownership in Pakistan (*ed*) . . 296
reclamation in Lancashire (*ed*) . 383
-tenure systems in West Indies . 174
The, Called Me (*br*) . . . 452
use advisory work by FAO . . 469
utilisation in Fiji . . . 187
Lanz implement supplies (*me*) . 247
Laterisation, measurement of . . 390
Latin America, agricultural production in, in 1954–55 . . . 8
agriculture in. . . . 112
Legumes, nitrogen and (*ed*) . . 96
weed treatment for . . . 219
Leveller for sugar-cane land . . 310
land . . (*me*) 122, (*me*) 458
Leys and ley management, effect on wheat (*ed*) 382
Lighting plant (*me*) . . . 90
Linseed, cropping of, in Australia . 471
Livestock in Fiji 188
production of, in France . . 60
SPC recommendations (*ed*). . 253

Living standards in West Germany . 307
Loader, hydraulic, midget (*me*) . 378
tractor (*me*) 455
Loading shovels (*me*) 414
Loans for purchase of farm machinery (*ed*) 333
Locusts, desert, 1954–55 campaign . 196
application of insecticides . 367
control of 197
measures taken by FAO against 80
Lucerne, control of weeds in . . 220
tree, as stock feed . . . 73

M

MCPA, weed control experiments with (*ed*) 381
Machinery, agricultural, Japan's . 482
Machinery and Equipment . . 90, 122, 163, 207, 245, 289, 375, 413, 455, 497
at the Royal Show, 1956 . . 322
exports, Australian . . . 427
British (*ed*) 421
flame-cleaning process for (*me*) . 458
for grading sugar-cane land . 310
for harvesting seaweed (*ed*) . 332
in Russia, new 317
in Yugoslavia 368
power, in irrigated areas . 386
sales drop in U.K. (*ed*) . . 298
trials by N.I.A.E. . . . 478
ultrasonic cleaning of (*me*) . 413
use of, in Fijian agriculture . 191
Malaya, cacao in 180
food production in . . . 142
forest improvements in . . 412
reserves in 494
Man and the Land (*br*) . . . 411
Manure spreader (*me*) . . . 416
Marketing of Tea, The Culture and (*br*) 373
Matches, Nyasaland poplars for . 407
Maize as Danish fodder crop . 448
beer as the product of (*ed*) . . 51
cultivation in Russia . . . 315
drier (*me*) 122
-growing in Poland . . . 240
improved USDA-34 . . . 371
production of, in South Africa . 20
some techniques for . . . 218
trials in Nigeria . . . 302
yellowing of, in South Africa . 147
Marketing methods designed by U.S. Department of Agriculture . . 476
Mechanisation of rice in Ceylon . 405
in French agriculture . . . 158
in Near East (*ed*) . . . 420
in Spain 440
in West German agriculture . 18
wheat, in Australia . . . 432
Medical research and diagnosis, use of isotope farm products in (*ed*) . 466
Mediterranean fruit fly, Mexican decree 372
Mexican agricultural prosperity . 183
Mexico, decree on Mediterranean fruit fly 372
1, trials with, in Kabba Province 302
Milk, production of, in France . 61
Mississippi Agricultural Experiment Station, corn experiments at (*ed*) . 129
Mist-blowing and mist-blowers . 367
Mixer and mincer (*me*) . . . 166
Moisture tester for grain (*me*) . 375
Money at Interest (*br*) . . . 120
'Moto-Matchette' (*me*) . . 497
Mow-drying of hay in Sweden . 447
Mower, 'Any Angle' (*me*) . . 498
German 206
mid-mounted (*me*) . . . 289
Mulching, dry-, of fallow land . 68
Music, effect of, on plant growth (*ed*) 2
Mycorrhiza, effect of, on tea . . 392
Myxomatosis, effect of, on British agriculture (*ed*) 171
toxicity of, in Australia (*ed*) . . 50

N

National Farmers' Union, new president 203
Institute of Agricultural Engineering, East African unit . . . 493
publications of . . . 483
role of 478
of Colonisation, Spain . . 439
NA-75 (*me*) 497
Vegetable Research Stations (*ed*) . 331
Near East and Africa, agricultural production in, in 1954–55 . . 8
mechanisation in (*ed*) . . 420
Netherlands, use of horses in (*ed*) . 128
New Guinea, rice project in . . 482
New publications 87, 120, 160, 204, 243, 287, 327, 373, 409, 452, 495
South Wales, linseed crops in . 471
Zealand, research on fruit-setting sprays used for tomatoes (*ed*) . 465
woody perennials in . . 220
Nigeria, black pod in . . . 302
Colonial Development Corporation activities in 353
maize trials in 302
Northern, pastures in . . . 494
Sudan Zone, reclamation of certain infertile areas . . 131
vegetation in 131
Nigerian Cocoa Farmers (*br*) . . 373
Nile water level 234
Nitrogen, consumption of, as fertiliser (*ed*) 297
legumes and (*ed*) . . . 96
Northern Ireland, tillage decline in . 159
Rhodesia, conservation in . . 182
Norway, member of International Plant Protection Convention . 313
Nozzle, spray (*me*) . . . 163
Nunne moth, control of the, in the Forest of Ebersberg . . . 78
Nutrient requirements of rice . 347
Nyasaland agricultural college . 157
planting of poplars in . . 407
rice project 242
tea industry, a review . . . 255

O

Oak wilt, eradication of . . . 280
Oats, wild, control of . . . 222
Oceania, agricultural production in, in 1954–55 7
OEEC Working Party on Fruit and Vegetables (*ed*) 463
Oil and water separator for air lines (*me*) 378
Opuntia megacantha see Prickly Pear
Orchard, automation in (*ed*) . . 331
equipment, developments in . 335
spraying by mechanical means . 336
Orchards, land cultivation in (*ed*) . 384
Overhead irrigation, water supplies and distribution from source to sprinkler 134

P

Pacific subsistence crops, sago . 177
Packaging of fruit . . . 337
Paddy, world production of . . 345
See also under Rice
Pakistan, ownership of land in (*ed*) . 296
rice borer in 354
tea production 493
Panning of soil 445
Paper container, universal (*me*) . 207
Pasture, effect of, on wheat . . 430
land, investigational work on, in Fiji 190
reclamation of, in St. Helena . 13
Pastures and stock in Spain . . 442
in Northern Nigeria . . . 494
phosphate and potash for (*ed*) . 130
Peanut cultivation in Thailand . 312
irradiation effect on (*ed*) . . 51
Peanuts and atomic radiation . . 119
occurrence of *Akrit* in Israel . 488
Pear crop survey, OEEC area, 1956–57 season (*ed*) . . . 464
Peas, control of weeds in . . 220
'Peck-Mix' mixer and mincer (*me*) . 166
Pepper, black, development of, in U.S.A. (*ed*) 2
development of, in Sarawak . 53
Perennials, woody, control of . . 220
Pest control in Hawaii . . . 65
new methods for . . . 41
practice of, in Hawaii . . 115
Pesticide absorption, field methods of estimating 239
Pesticides, residues from, in foodstuffs 366
hazards from (*ed*) . . . 383
toxic hazards of . . . 370
Pests and diseases in the Nyasaland tea industry 257
of foodstuffs in Store (Europe and Mediterranean) 1953–54 . 205
control of 148
destruction of, in the Rupununi Savannahs 111
Phosphate, availability of (*ed*) . 213
for the fertilisation of grassland (*ed*) 130
Phosphates, consumption of, as fertiliser (*ed*) 297
ground rock, direct application of 151
Phytopathology in Venezuela . . 106
Pick-up hitch (*me*) . . . 375
Pineapple production, Malayan lag in 159
the cultivation of, in Hawaii . 114
Pineapples, development of, in Sarawak 57
Piptadenia africana, effect of, on cocoa production 356
Plant breeding, practical value of . 426
Cultivation and Acclimatisation Institute in Poland . . . 206
growth and the weather . . 205
effect of music on (*ed*) . . 2
nutrients, rain and the (*ed*) . . 170
Protection Conference (*ed*) . . 295
stations in Yugoslavia . . 444
Planting and seeding for erosion control 193
Plants, cure and prevention of virus diseases in 393
Flowering, Features of Evolution in the (*br*) 452
proteins from (*ed*) . . . 4
Plants, The Hardiness of (*br*) . 495
Plastic bags for silage (*ed*) . . 252
coatings for citrus fruit . . 150
Plough, direct-connected (*me*) . 416
vineyard (*me*) 246
Ploughing, World Contest, 1956 (*ed*) 464
Ploughs, reversible, mounted (*me*) . 457
Point IV mission in Ethiopia . . 328
Poland, agricultural policy (*ed*) . 171
cultivation of walnuts in . . 25
fruit-growing in . . . 344
industrial crops in . . . 202
land reclamation in . . . 202
maize-growing in . . . 240
Plant Cultivation and Acclimatisation Institute in . . . 206
Poplars for match production . 407
Population in Fiji 187
Portugal, wheat agreement with U.S.A. 321
Potash, consumption of, as fertiliser (*ed*) 297
problems (*ed*) 216
Potato digger (*me*) 209
harvester, N.I.A.E. design . . 480
harvesting (*ed*) 215
Potatoes, increased yield of, with shelter belts (*ed*) . . . 332

Powdery mildew fungus, cereal resistance to 206
Pressure control for sprays . . 232
Price stabilisation and crop adjustment by U.S. Department of Agriculture 477
Prickly pear, biological control of . 401
Propagation by hardwood cuttings . 308
Proteins from plants (*ed*) . . . 4
Pruning by mechanical methods . 335
P.t.-o., independent (*me*) . . 414
Pump, electric, self-priming (*me*) . 375
sets, mobile, Egyptian (*me*) . . 166
vane-type (*me*) 167
Pumps, stirrup 231
Pyrethrum, development of . . 106
marc 427

Q

Quinoa, cultivation of, in Greenland 477

R

Rabbit clearance operation in Britain 288
Rabbits, absence of, in Britain (*ed*) . 171
Radiation process to ripen fruit . 397
Radioactive treatment for barley . 319
Radioisotope tracers, use of, in agriculture (*ed*) 170
Radioisotopes, value of, to agriculture 278
Ragwort, treatment of, in Northern Ireland (*ed*) 333
Rain-producing experiments (*ed*) . 298
Rakes, use of, for land clearing . 140
Ranching, in Latin America . . 109
Ransomes, Sims and Jefferies Ltd., new factory 349
Ratooning of rice 71
use of, in sugar-cane plantations . 66
Reaper, mechanical, for seaweed (*ed*) 332
Reclamation project, China (*ed*) . 170
Research, agricultural, Colonial (*ed*). 52
in Hawaii 114
arid zone 11
British agricultural (*ed*) . . 51
by U.S. Department of Agriculture 476
development of, in Hawaii . . 64
establishments, organisation of, by FAO 469
Residues from pesticides in foodstuffs 366
Rhodesia and Nyasaland, tobacco research in 40
fertiliser factory expansion in . 62
increased land under cultivation (*ed*) 381
See also under Northern Rhodesia *and* Southern Rhodesia
Rhône Valley Scheme (*ed*) . . 1
Rice, an economic and agronomic summary 299
borer in Pakistan 359
consumption in Fiji . . . 189
-cultivation experiments . . 40
cultivation of, in Sarawak . . 54
development of, in Australia . 41
in Hawaii 118
in Japan (*ed*) 1
industry in Australia . . . 40
irrigation of 67
mechanisation of 302
in Ceylon 405
moves Northward 146
new plan for Australia . . 367
nutrient requirements of . . 347
production forecast for . . 9
in tropical and semi-temperate climates 345
physical aspects of . . . 301
project in Netherlands New Guinea 482
in Northern Territory . . 482
in Nyasaland 242
ratooning of, on the Swaziland irrigation scheme 71
Rice, world consumption of . . 300
Roll-up doors (*me*) 92
Root cutters, land clearing . . 137
harvester (*me*) 500
Rotary cultivator (*me*) . . . 247
Royal Show, 1956, report on . . 322
Rubber, development of, in Sarawak 56
production forecast for . . 10
replanting plan in Malaya . . 226
Rupununi Savannahs, subsistence farming in the 110
Russia, agriculture in (*ed*) . . 215
farming in (*ed*) 128
increased crop yields in, with shelter belts (*ed*) . . . 331
joins Plant Protection Convention 313
See also Soviet *and* U.S.S.R.
Rye as Danish fodder crop . . 448

S

Sack lifter (*me*) 413
Safety on the farm (*ed*) . . . 420
precautions, agricultural (*ed*) . 128
with agricultural aircraft . 150
Safflower seed, value of . . 108
Sago, composition of . . . 178
in Sarawak 56
Pacific subsistence crop . . 177
palms, treatment of . . . 178
St. Helena, agricultural development in 12
Sarawak, crop production in . . 53
work of the Department of Agriculture in 53
Saw, electric chain (*me*) . . 91
Sawfly, wheat trials in Canada. . 425
Scientist, world food and the . . 159
Screw-worm, eradication of . . 279
Scrub cutting 412
Seaweed for fertility . . . 285
mechanical harvesting of (*ed*) . 332
Seed, atoms for (*ed*) . . . 1
drill (*me*) 245
-production scheme in Cyprus . 284
-spacing drill (*me*) . . . 415
Seeds, viability methods . . 311
Selenite method for testing viability of seeds 311
Shale dump reclaimed for agriculture (*ed*) 383
Shares, plough, blade-type (*me*) . 245
Shed, implement (*me*) . . . 245
Sheep, fodder trees for (*ed*) . . 216
Sheep trailer (*me*) 246
Shell Agricultural Centre at Woodstock 326
Shelter belts, for increased crops (*ed*) 331
Sholderhi (*me*) 164
Shovels, loading (*me*) . . . 414
Shrubs, eradication of . . . 131
Silage (*br*) 327
manufacture of 107
plastic bags for (*ed*) . . . 252
Silver iodide, use of, for seeding clouds (*ed*) 169
Smallholder, copra production by 435, 489
Small-scale farming in the West Indies 173
Smithfield Show and Agricultural Machinery Exhibition . . 26
Snowy Mountains Scheme . . 483
So Bold An Aim (*br*) 87
Soda ash 501
Soil analysis (*corr*) 244
builder, double-deck (*me*) . . 165
capping 445
conditioners, dextran (*ed*) . . 127
conservation conference in India . 319
in Hawaii 116
in Northern Rhodesia . . 182
erosion of, in Africa (*ed*) . . 295
fertility and management (*ed*) . 381
improvement in Hungary . . 11
problems investigated by N.I.A.E. 480
Soil residual effects of crop-protection chemicals in 366
Soils, glasshouse, sterilisation of . 502
irrigated, management of . . 385
tea, and their management . . 389
Solar energy 339, 342
role of, in chlorella farming . 398
power units 399
projects, suitable regions for . 343
still 241
Sorghum, for silage 107
syrup, manufacture of (*ed*) . . 297
production of, in U.S.A. (*ed*) . 297
South Africa, agricultural development in 20
control of prickly pear in . . 401
yellowing of maize in . . 147
African agricultural developments 320
citrus, plastic coating for . . 150
Southern Rhodesia, farm-settler plan in 402
forest reserves in 493
increased agricultural area (*ed*) . 422
irrigation scheme . . . 471
new farming area in . . 40
Soviet agriculture (*ed*) . . . 215
various aspects of . . . 314
Collective Farming (*br*) . . 409
See also under U.S.S.R. *and* Russia
Soya bean, adaptation of, in Sweden 99, 102, (*err*) 159
temperature and light demands of 100
Spain, advances in agriculture . 439
tractor production in . . . 147
Spout flow indicator (*me*) . . 376
Spray gun . . (*me*) 124, (*me*) 456
nozzle (*me*) 163
wide-angle 38
Sprayer, air-blast, for vines . . 338
Brussels-sprouts (*me*) . . 165
compression 231
crop . . (*me*) 90, (*me*) 166
Sprayers (*me*) 124
boom 231
computor for (*me*) . . . 163
pneumatic 232
pressure-retaining . . . 232
Spraying, advantages of . . 229
by helicopter 222
machines for the small-scale farmer 230
mechanical, for orchards . . 336
project in Australia . . . 259
Sprays, fruit-setting, difficulties encountered in use of (*ed*) . . 465
mechanics of producing . . 366
Spreader, manure (*me*) . . . 416
Stacker, electric (*me*) . . . 90
Stapleford forestry development . 262
Steel Squirrel (*me*) . . . 246
Stem-rust trials in Canada . . 425
Streams, measurement of flow rate in 134
Stubble, treatment of, in Australia . 431
Stumper, detachable . . . 140
Stylosanthes gracilis as a green crop in tea 260
growth habit of 260
Subsistence crops, Pacific . . 177
Sudan, irrigation by using solar pumping units 343
Sugar-beet harvesting, compressed-air (*me*) 245
production of, in Afghanistan . 21
Sugar Cane Around the World (*br*) . 453
cultivation in Thailand . . 312
development of, in Swaziland . 67
farming in South Africa . . 320
fertiliser for, in Hawaii . . 65
harvesting of, in Hawaii . . 66
ratooning of, in Hawaii . . 66
investigational work on, in Fiji . 189
surface drainage for . . 309
Technologists' Conference . 145
weeds in 219
factory for Ceylon 206

Sugar production forecast for . . 9
in Hawaii 64
in South Africa . . . 21
scheme, million-acre, in Rhodesia 206
Superphosphate, alternatives to . 151
use of, in Northern Nigeria . . 132
Swaziland Irrigation Scheme . . 67
Sweden, chemical weed control in . 365
haymaking methods in . . 447
soya-bean adaptation in . . 99
Swedes, reaction of, to phosphate . 151
Sweet potatoes in Sarawak . . 57
Syringes, garden 231

T

Tanganyika Farmers' Association (Co-operative) Ltd. . . . 37
rain experiments in (*ed*) . . 298
Tea and tea plant, regional variation of 263
commercial selection and breeding of, in India 263
estates, cost of opening up, in India, Ceylon and Africa . 269
experimental work in the Nyasaland tea industry . . . 258
future of, in Nyasaland . . 259
homogeneity of plants . . 267
influence of commercial seed in Assam 265
-manufacturing methods in Nyasaland 256
production forecast for . . 10
seed, improved 266
selection of clones in India . . 265
soils and their management . . 389
Stylosanthes gracilis as a green crop in. 260
The Culture and Marketing of (*br*) 373
Teak forests in East Pakistan . . 77
Terminalia superba, effect of, on cocoa production 356
Terrace works, simple, in Japanese erosion control 192
Tetrazolium method for testing viability of seeds . . . 311
Thailand, increased cultivation . 312
Tilletia tritici. *See* Bunt
Timber, production forecast for . 10
See also under Forest, Forestry etc.
Tobacco, development of, in Sarawak 57
effect of copper on (*ed*) . . 333
Indian research . . . 372
in South Africa . . . 320
production forecast for . . 10
research, importance of . . 40
Tomatoes, fruit-rot attacks after spraying to set fruit (*ed*) . . 465
Top-dressing, aerial, in New Zealand 40
'Topping' of grassland (*ed*) . . 296
Tornadoes, control of (*ed*) . . 169
Toxic chemicals, hazards from use of, in agriculture 365
Toxicity, mechanism of, of insecticides and fungicides . . . 364
with reference to fungicides . 363
of insecticides, mechanisms of . 363
of pesticides 370
Trace elements, deficiencies of, in crops (*ed*) 214
Tracers, radioactive, to measure nutrient availability . . . 280
Track-Marshall, earthmoving equipment for (*me*) 456
Tractor, Albion Cuthbertson 'Water Buffalo' (*me*) 500
attachment, slow-speed (*me*) . 165
cabin (*me*) 290
crawler (*me*) 92
efficiency, effect of tyre slippage on 477
factory for Chile . . . 200
Ferguson 35 492
battery for (*me*) . . . 378
loader (*me*) 455
Tractor, Porsche-Diesel A133 . 499
pulling device for (*me*) . . 90
radio-controlled . . . 46
'Rhino' (*me*) 207
trailers . . (*me*) 123, (*me*) 413
trials by N.I.A.E. . . . 478
-tyre girdle (*me*) . . . 209
winch (*me*) 208
Tractors, agricultural, application of hydrostatic transmission to . . 481
Brazil as market for . . 449
British, in India . . . 338
increased use of. . . . 354
production of, in Spain . . 147
VR180 142
Trade Fair, International, in Damascus 244
Trailer, sheep (*me*) . . . 246
Trailers, tractor . (*me*) 123, (*me*) 413
Transportation, methods of, for sugar-cane 66
Trappists, farming system of, in France 494
Trash, disposal of . . . 280
Travancore-Cochin, coconut plantations in 317
Tree shelter-belts, increased crop yields with (*ed*) . . . 331
Treedozer, use of 140
Trees, festival of (*ed*) . . 216
Trench digger (*me*) . . . 377
Triplochitum scleroxylon, effect of, on cocoa production . . . 356
Tropical agriculture, limiting factors in 227
Tropics, new maize for . . . 371
Truck, tipping, glass-fibre (*me*) . 248
Trucks, fork-lift (*me*) . . 289
Turfing, method of, in Japan . . 192
Tyre, agricultural (*me*) . . . 455
slippage 477

U

U.K. farm machinery (*ed*) . . 127
fertiliser consumption (*ed*) . . 466
See also under British
U.S. agricultural surplus (*ed*) . . 97
Atomic Energy Commission, new radioisotope farm (*ed*) . . 465
Department of Agriculture, creation of. 476
work of 475
farm bill veto (*ed*) . . . 254
surplus (*ed*) 251
forest resources, responsibility of U.S. Department of Agriculture 477
U.S.A., agricultural policy for (*ed*) 49, (*ed*) 97
production in, in 1954–55 . 5
black-pepper production in (*ed*) . 2
liquid fertilisers in (*ed*) . . 129
production of sorghum in (*ed*) . 297
wheat agreement with Portugal . 321
USDA-34, improved . . . 371
U.S.S.R., agricultural production in, in 1954–55 7
farm production (*ed*) . . . 172
forestry seminar in . . . 372
machinery on kolkozes . . 410
See also under Soviet *and* Russia
Ultrasonic cleaning (*me*) . . 412
Universal paper container (*me*) . 207
Urea–formaldehyde fertilisers (*ed*) . 421
Urocystis tritici. *See* Flag Smut

V

Valve, pressure relief (*me*) . . 415
van Damme plough . . . 434
Vegetable research (*ed*) . . . 331
Vegetables in Hawaii . . . 117
weeds in 221
'Vegetation blocks' for erosion control 195
in Northern Nigeria . . . 131
Venezuela, farm service in . . 104
phytopathology in . . . 106
Shell agricultural service in. . 104
Viability of seeds, new methods for testing 311
Villiers booklets, spare parts (*me*) . 292
Vine sprayer, air-blast . . . 338
Vineyard plough (*me*) . . . 246
Virus disease, cure and prevention of, in plants 393
Virus for liquefying caterpillars (*ed*). 127
Viticulture in France, progress in . 143

W

Wales, Agricultural Sub-commission in (*ed*) 95
report on agriculture in (*ed*). . 420
Walnuts, cultivation of, in Poland . 25
Water and oil separator for air lines (*me*) 378
distillation of, with solar energy . 241
problem and its relation to solar energy 339
storage and quality for irrigation . 387
storages, reducing evaporation from 369
supplies, natural, measuring rate of 134
use advisory work by FAO . . 469
Weed control, chemical, in Sweden . 365
economics of 223
equipment for . . . 228
experiments at NIAB (*ed*) . 381
handbook, 1956 . . . 205
in Hawaii 115
in the production of Cyprus cereals 283
problems in world agriculture . 217
Weedkillers, general . . . 218
selective 217
Weeds (*ed*) 333
dis-orientated (*ed*) . . . 215
West German agriculture, changes in 306
postwar development in . 15
Germany, farming in (*ed*) . . 4
Indian development (*ed*) . . 3
Indies, small-scale farming in the. 173
Wheat and barley production in Cyprus 281
Australian, baking quality and market requirements of . . 433
better-yielding varieties in Australia 432
breeding and production in Canada 423
of disease-resistant varieties . 432
changing pattern of growing, in Australia 429
effect on, of leys and ley management (*ed*) 382
-farming costs in Australia . . 431
developments in Australia . 428
fundamental studies on . . 426
Industry, The, in Australia (*br*) . 452
mechanisation in Australia . . 432
new research station in Dublin (*ed*) 419
pastures and weeds in. . . 430
production forecast for . . 9
of, in South Africa . . 20
prospects in Argentina . . 438
role of plant breeding. . . 424
sawfly-resistant 425
stem-rust trials in Canada . . 424
UN conference on (*ed*) . . 1
varieties in Cyprus . . . 282
world stocks continue to increase (*ed*) 382
Wheats, durum, breeding of, in Canada 426
Thatcher and Marquis . . 426
winter, in Australia . . . 433
in Canada 425
Wicker work and masonry in Japanese erosion control 192
Winch, portable (*me*) . . . 92
tractor (*me*) 208
Wind speed indicator (*me*) . . 377

Windrower, self-propelled (*me*) . 289
Wine-growing in France . . 144
Wonsover machine (*ed*) . . 97
Work study for farmers (*ed*) . . 422
World agricultural production, 1954–55 5
Crop Reports .. 47, 93, 125, 167, 211, 249, 293, 329, 379, 417, 461, 503
World Eucalyptus Conference, 1956 427
Ploughing Contest, 1956 (*ed*) . 464
Sugar Cane Around the (*br*) . 453
World's food supplies, factors affecting 303

Y

Yugoslavia, agricultural progress in . 153
Yugoslavia, crop protection in . 443
machinery, co-operatives and land limitation in 368
postwar production trends in . 154

Z

Zuider Zee, reclamation of (*ed*) 334, 434

AUTHOR INDEX

ALLEN, H. P., B.SC., PH.D.: Weed Problems in World Agriculture . 217
ASHBY, D. G., M.A., and PFEIFFER, R. K., PH.D.: Weeds: A Limiting Factor in Tropical Agriculture . 227
BARRAU, JACQUES. *See* Massal, Emile
BAWDEN, F. C., M.A., F.R.S.: Cure and Prevention of Virus Diseases in Plants 393
BERTIN-ROULLEAU, J.: Mechanisation in French Agriculture . . 158
BRANAS, PROF. J.: Progress in the French Wine-Growing Industry . 143
BRANCKER, A. V., PH.D.:
Solar Energy
Part I—The Water Problem and its Relation to Solar Energy . 339
Part II—Solar Power Units and the Future 398
BROWN, C. H., B.SC.: The Rupununi Savannahs 109
CARPENTIER, L. J.: The Role of Fertilisers in Rice Production in Tropical and Semi - Temperate Climates 345
CASS, W. G.: Soviet Agriculture: Official Urge for Increased Production 314
COOKE, F. C.:
Copra Production by the Smallholder
Part I 435
Part II 489
COOKE, G. W., PH.D., F.R.I.C.: Alternatives to Superphosphate . . 151
DENNISON, E. B.: B.SC., DIP.AGRIC., DIP.TROP.AGRIC.: Problems of Reclaiming Certain Infertile Areas in the Sudan Zone of Northern Nigeria (Kano Province) . . 131
DIAS, G. R. W., A.M.I.B.A.E.: Rice Mechanisation in Ceylon . . 405
DONCHEV, SVETOSLAV: Developments in Bulgarian Agriculture — II. Character of Co-operative Farms. 275
EVANS, L. J. C.: The Swaziland Irrigation Scheme—I. Introduction 67
EVELYN, S. H.: The Swaziland Irrigation Scheme—II. Groundnut-shell-mulching of Fallow Land 68
FORD, E.: Farming from the Air: American Experience . . 148
GOULDEN, C. H.:
Agricultural Progress in Canada—III. Canada's Barley Crop . 235
Wheat Breeding and Production in Canada 423
GRAY, C. M., O.B.E., E.D., M.SC., A.M.I.E.(AUST.): The Snowy Mountains Scheme 483
HAKANSSON, RICHARD: New Methods of Haymaking in Sweden . . 446
HAMPSON, C. P., B.SC., M.I.BIOL.: Economics of Weed Control with Special Reference to MCPA . 223
HARLER, C. R.:
Cost of Opening Up Tea Estates: Expenditure in India, Ceylon and Africa 269
Tea Soils and their Management . 389
HARRIS, E.: Role of the National Institute of Agricultural Engineering 478
HELLER-COHEN, ORA. *See* Plaut, Menko
HOBLYN, T. N.: Some Difficulties in Field Experimentation with Cocoa on the Gold Coast . . 355
HOLMBERG, SVEN A.: Soya-bean Adaptation in Sweden 99, (*err*) 159
HOWARD (SIR) HERBERT: Commonwealth Agricultural Bureaux Organisation 472
HUME, H. NUTCOMBE, C.B.E.: Work of the Colonial Development Corporation 350
HUMPHREY, NORMAN: Agricultural Development in St. Helena. . 12
JIMÉNEZ-CUENDE, FRANCISCO: Advances in Spanish Agriculture . 439
JOLLY, A. L., PH.D.(LOND.), M.A., M.SC.: Small-scale Farming in the West Indies 173
KRAŠOVEC, PROF. STANE: Agricultural Progress in Yugoslavia. . 153
KRATOCHVIL, FRANTIŠEK: Rice Moves Northward 146
LAMPREY, H. F.: Control of Game and Vermin Animals . . . 81
LAYCOCK, D. H.: A Review of the Nyasaland Tea Industry . . 255
LEAN, O. B.: Desert Locust Situation, 1954–55 196
LEICHUM, DR. HANS: European Grass-seed Situation . . . 403
LENGELLÉ, MAURICE:
Present Conditions and Future Outlook for French Agriculture 59
Progress Report on the French Agricultural Situation . . 408
Report on the French Agricultural Industry 318
LOFTUS-TOTTENHAM, T.: Seaweed for Fertility 285
MACALPINE, R. I.: *Stylosanthes gracilis* as a Green Crop in Tea . 260
MACGILLIVRAY, PROF. JOHN H.: Factors Affecting the World's Food Supplies 303
MACINDOE, S. L.: Wheat-farming Developments in Australia . . 428
MARSH, R. W.: Crop Protection in Jugoslavia. 443
MASON, R. R. *See* Payne, W. J. A.
MASSAL, EMILE, and BARRAU, JACQUES: Pacific Subsistence Crops: Sago 177
MELVILLE, EDWINA: Subsistence Farming in the Rupununi Savannahs 110
MILLER, R. W. R., B.A., DIP.AGRIC. SCI.(CANTAB.): The Work of the Sarawak Department of Agriculture 53
NAUDE, DR. T. J.: Biological Control of the Prickly Pear . . . 401
OHMASA, MASATAKA: Japanese Experience in Protective Planting . 192
PARISONOS, J., B.SC.: Wheat and Barley Production in Cyprus . 281
PAYNE, W. J. A., and MASON, R. R.: Agricultural Developments in Fiji 187
PEARSON, DR. PAUL B.: Atomic Energy's Contribution to Agriculture 277
PEDERSEN, SIGURD, M.SC.:
Future Problems in Danish Agriculture 238
New Fodder Crops in Danish Agriculture 448
PFEIFFER, R. K., PH.D. *See* Ashby, D. G., M.A.
PLAUT, MENKO, and HELLER-COHEN, ORA: New Methods for Testing Viability of Seeds . . . 311
RAMANATH, S.: The Bhakra-Nangal Project 74
RIEMANN, DR. F.:
Changes in the Structure of West German Agriculture . . 306
Postwar Development in West German Agriculture . . 15
SAMUEL, DR. L. E.: The State of Agriculture in Israel . . . 22
SAVESON, IRWIN L.: Precision Surface Drainage of Sugar-cane Land 309
STOWER, J. S.: Overhead Irrigation: Water Supplies and Distribution from Source to Sprinkler . . 134
SZOKOLAY, G.: The Swaziland Irrigation Scheme—III. Ratooning of Rice on the Swaziland Irrigation Scheme 71
THIELMANN, K.: Control of the Nunne Moth in the Forest of Ebersberg: Report on the Use of DDT Fog 78
THISTLE, ALAN:
Agricultural Crops in Hawaii
Part I 63
Part II 114
Biological Control of the Giant African Snail in Hawaii . . 233
THORNE, WYNNE: Managing Irrigated Soils 385
TUNSTALL, A. C., B.SC.: Spraying Machines for the Small-scale Farmer 230
VANTER, WARNER: There in the Jungle Malaya's Cacao Grows . 180
WIGHT, W.: Commercial Selection and Breeding of Tea in India . 263
WULFF, B. W. J.: Developments in Orchard Equipment: A Summary of Progress in Britain. . . 335
ZHELEV, DIMITER: Developments in Bulgarian Agriculture—I. Co-operative Farming in Bulgaria . 273

443
368
154
434
53
401
192
281
187
277
238
448
311
74
306
15
22
309
134
71
78
63
114
233
385
230
180
263
335
273
956

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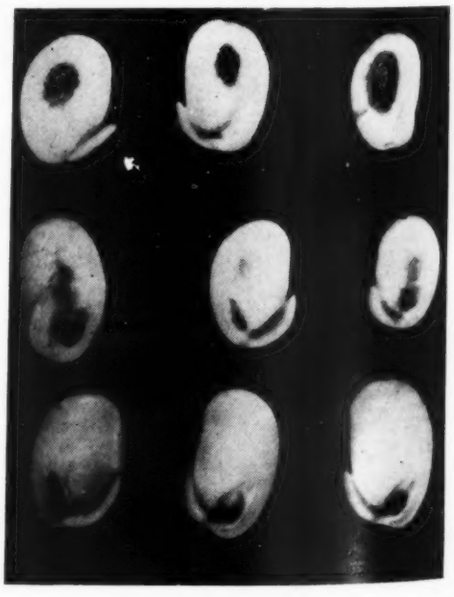

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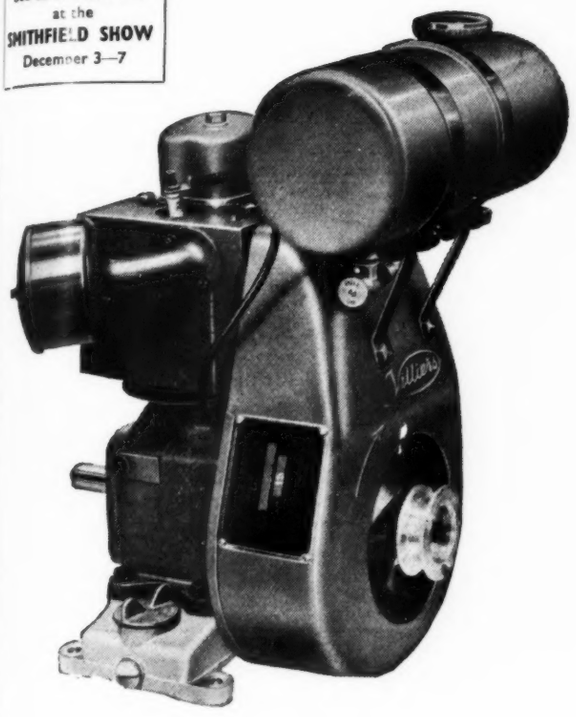

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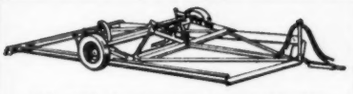

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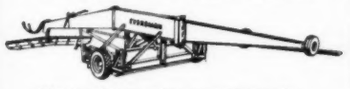

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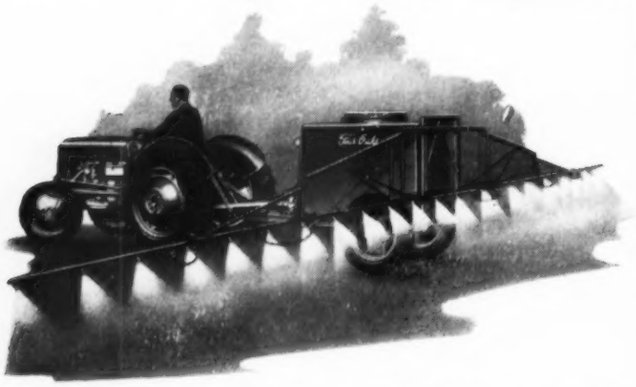

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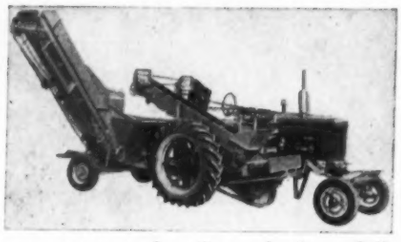

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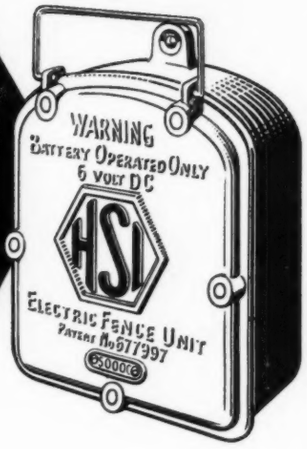

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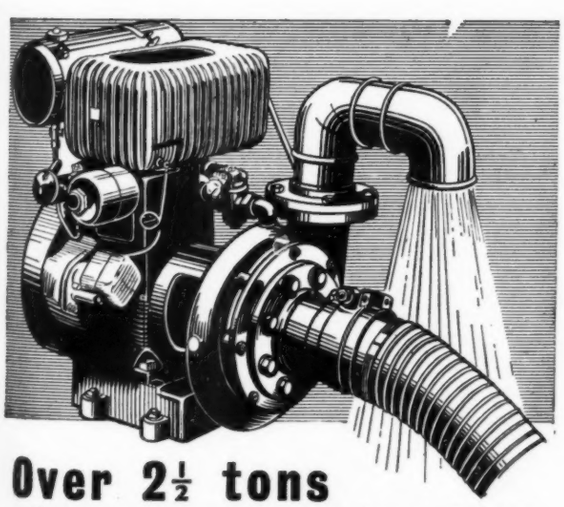

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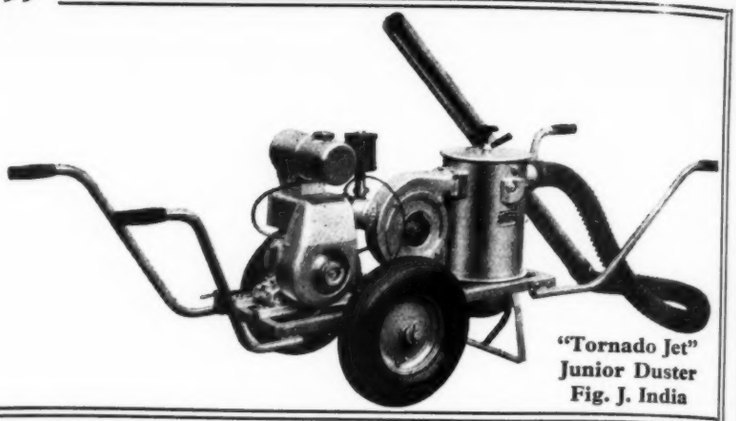

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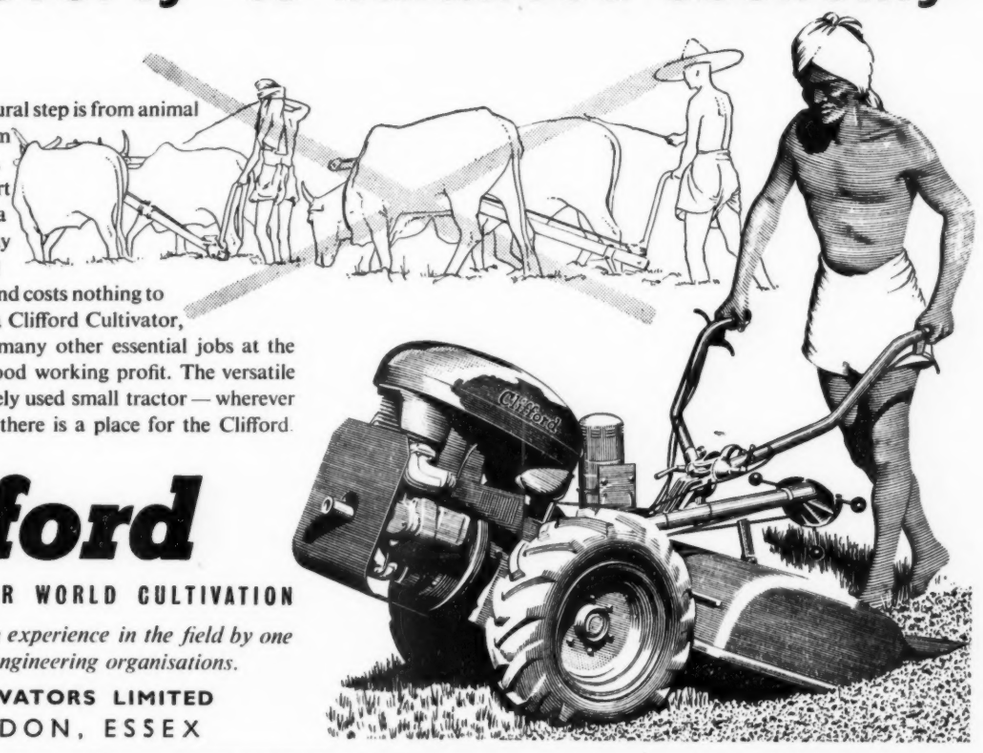

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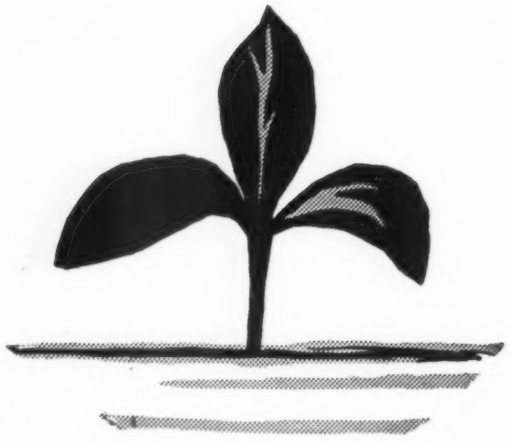

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